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There are currently three databases supported by three different commands that collect and output basically the same type of information: PACER, SHAREM, and AIREM. These systems contain initial detection data, tracking data, environmental data, system performance data, and weapon performance data. This thesis investigates the commonalities and differentces in structure and content of the three databases, and examines the feasibility of integrating PACER, SHAREM, and AIREM into a single database. The benefits of this database integration are a more comprehensive utilization of data, reduced data collection for fleet users, and a standardization of how the data is analyzed.

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Feasibility for the Integration of ASW Information Databases

by

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of the requirements for the degree of

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ABSTRACT

There are currently three databases supported by three different commands that collect and output similar ASW information: PACER, AIREM, and SHAREM. These databases contain initial detection data, tracking data, environmental data, system performance data, and weapon performance data. This thesis investigates the commonalities and differences in structure and content of the three databases, and examines the feasibility of integrating PACER, AIREM, and SHAREM into a single database. The benefits of this database integration are a more comprehensive utilization of data, reduced data collection for fleet users, and a standardization of how the data is analyzed.

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I. INTRODUCTION

A. BACKGROUND

Three different antisubmarine warfare information databases exist in the Navy: the Air Effectiveness Measurement (AIREM) program database, the Ship Antisubmarine Warfare Readiness/Effectiveness Measuring (SHAREM) program database, and the air and surface Post-Operational Analysis Critique and Exercise Review (PACER) program databases. These three databases collect and provide basically the same type of information:

- sensor performance
- weapon performance
- ASW system performance
- crew performance

These three programs conduct exercises to study the detect-to-engage sequence of the ASW problem by analyzing the above factors. Because the PACER, SHAREM, and AIREM databases operate in the same environments and provide comparable results, a logical question arises whether it is feasible to integrate them. By integrating the databases, the amount of information available for reconstruction and analysis will

increase, database maintenance is simplified, and redundant data eliminated.

B. OBJECTIVES

There are two principal objectives to this thesis: 1. to determine the structure of a common database schema which integrates the three databases in question; 2. to show that the schema can be used to satisfy the measures of effectiveness for the exercise objectives.

To accomplish these objectives, data requirements for the current systems must be identified and steps taken to ensure they are satisfied in the consolidated database. Also essential for a successful integrated schema design is the ability to replicate the queries and reports that the present database management systems support. Each current database is under the cognizance of entirely different organizations. As a result, implementation of an integrated database schema will likely encounter serious political obstacles.

C. METHODOLOGY

The first step towards integrating the three databases is to identify all the synonym and homonym data fields. A consistent naming structure must be applied to both the synonyms and homonyms. Once this is accomplished, a database schema can be developed, providing the framework for the establishment of the necessary tables and their corresponding

attributes. To assist in this process, entity-relationship diagrams will be constructed for each of the three databases to identify their commonalities. Using these commonalities, a new schema will be devised which combines the appropriate tables from the component databases into an integrated database. Next, a discussion of the eight measures of effectiveness will demonstrate how the integrated database will meet the data query and operational requirements of the component database's. Once the integrated database is up and running, a method for providing access to all the users must be established. In this case, a distributed database system will be examined.

D. SCOPE

The purpose of this thesis is to study the feasibility of an integrated database, not the implementation of that database. In order to implement the new database, a mainframe database management system would be required as would software support to conduct complete reconstruction analysis, such as track construction from positional data, tracking accuracies by comparing target positional data to contact data, and so forth.

E. ORGANIZATION OF STUDY

A detailed description of the three databases being investigated will be presented, including a general overview

of what each database is, its function, and how it operates. This will be followed by an analysis of the similarities and differences between the databases. It is this area of research that will provide the foundation for constructing the integrated database. Next will be a description of how the new database was built, including the schema formulation and the actual assembly of the tables and their attributes. Once the schema has been established, a delineation of the analysis objectives will be presented and how these objectives are obtained and displayed from the integrated database. The last section will provide a summary and offer recommendations as a result of the study.

II. DATABASE OVERVIEW

PACER, SHAREM, and AIREM all provide information on various aspects of ASW. In order to determine whether it is reasonable to combine them into a single database, it is necessary to examine what information each database contains and for what purposes each is used.

A. PACER

The Post-operational Analysis Critique and Exercise Review program was originally developed to provide Commander Third Fleet a comprehensive antisubmarine warfare exercise reconstruction and analysis program [Ref. 1:p. 2]. Since then it has grown into a standard Navy program, providing ASW data analysis for both surface ships and aircraft. When PACER first began, it was conducted only on instrumented ranges. Now, through advances in data reconstruction, PACER is conducted in both ranges (structured) and open ocean (free-play) environments.

The PACER exercises concentrate primarily on the detect-to-engage sequence, focusing on equipment and watch station performance. A unique characteristic of this program is that it does not add an additional data collection burden for the subject unit, rather, it utilizes information that is normally gathered [Ref. 1:p. 8]. The data are then merged and analyzed

by the PACER Analysis Data System (PADS) to provide both a video and hard copy output [Ref. 1:p. 8]. This output can then be used to make an accurate assessment of a particular unit's material and training readiness [Ref. 1:p. 9]. In fact, PACER results can identify equipment deficiencies down to the component level [Ref. 1:p. 10]. Products from PACER are intended not only for individual units but also for intermediate and advanced battle group work-ups. To ensure PACER fulfills its intended mission, it is tasked to look at these specific areas:

- target detection
- target localization
- weapon order computation and transmission
- time of fire solution
- torpedo performance
- target response

By analyzing these certain areas, PACER provides an accurate and quantitative method of measuring the equipment and personnel performance of the entire ASW system.

The PACER database currently resides on a relational spreadsheet type database management system. Naval Undersea Warfare Engineering Station (NUWES), Hawaii detachment is in the process of establishing a new conventional table and attribute design that will be resident on a Sun work station, and this is what will be examined. This update will improve

the ability to conducted cross exercise queries and analyze trends. The PACER database uses a "bottom up" data gathering and analysis approach. This method allows for a wide range of queries and analysis possibilities. The information in the PACER database is classified secret and provides different access levels for different personnel depending on their role in the system.

Both the air and surface PACER databases allow for the gathering and manipulation of a large amount of data. The information collected spans the entire antisubmarine problem, from initial contact to the performance of the torpedo.

The tables are divided such that like data elements are grouped together. The general areas of division are as follows:

- administration
- acoustic/environmental data
- weapon information
- platform equipment configuration (Surface PACER only)
- tracking and fire control/attack information
- platform and weapon system performance

Both the air and surface database description and data dictionaries can be found in appendix A.

B. SHAREM

Sponsored by the Chief of Naval Operations (CNO), the Ship Antisubmarine Warfare Readiness/Effectiveness Measuring program was developed in 1969 to provide a quantitative method of measuring surface ships' antisubmarine warfare (ASW) performance [Ref. 2:p. 1]. In 1973, the SHAREM program was expanded to encompass surface ASW tactics development.

In order to fulfill program requirements, SHAREM exercises are conducted in both structured and free-play exercise environments. These exercises are conducted on both instrumented ranges and open ocean areas and targeted towards a particular area or areas of interest. Long range detection and tracking exercises are usually conducted in open ocean whereas attack exercises are conducted on instrumented ranges. The purpose of detection exercises is to observe sensor performance, detection, localization, classification performance, and command and control performance [Ref. 3:p. 1]. The purpose of attack exercises is to observe tactics, fire control accuracy, weapon performance, and vulnerability to submarine attack [Ref. 3:p. 1]. These findings provide valuable insight into identifying problem areas for further study.

There are eight program objectives, four primary and four secondary, to ensure SHAREM goals are achieved. These objectives are:

Primary

- measure the detection effectiveness of acoustic and nonacoustic ASW sensors
- measure the contact classification effectiveness of acoustic and nonacoustic ASW sensors
- measure the accuracy and timeliness of ASW localization procedures and tactics
- measure the effectiveness of ASW attack procedures, weapons, and tactics

Secondary

- evaluate the effectiveness of ASW command, control, communications, and intelligence (C3I) and data fusion in task force ASW operations
- measure the vulnerability-to-detection and vulnerability-to-attack of surface ships operating singly or in groups under various conditions and acoustic Emission Control (EMCON) and ship quieting
- measure the material readiness of ASW systems and the effectiveness of maintenance procedures available to ship's force
- evaluate the ability of ASW forces to exploit the environment during task force ASW operations

After quantifying and combining the effectiveness of the primary objectives, an expression of overall ASW effectiveness can be formulated. However, the secondary objectives cannot be combined, and are used to individually measure a supporting ASW mission [Ref. 2:p. 3]. Instrumented ranges are not required for all SHAREM exercises because an essential data element is the self recorded track history of each participant. This database allows for extensive amounts of

data to be collected during antisubmarine exercises and operations. The data is collected from the following general areas:

- administration
- platform equipment configurations
- environmental/acoustic data
- contact information
- attack and tactic information
- command and control

With this information, analysts can reconstruct pertinent events and compare them to the results obtained by the exercise units.

The SHAREM database resides on the ShareBase 8000 relational database management system. This management system requires a mainframe computer and is an extremely powerful package. The SHAREM database utilizes a "bottom up" data usage approach [Ref. 4:p. 2]. For example, as previously mentioned, individual unit positional data are collected and used to calculate the bearings and ranges to contacts. A relational database management system is used because the CNO has directed the SHAREM database to have the capability of handling any query posed, even those that have not been contemplated or conceived [Ref. 4:p. 3]. The information contained in the SHAREM is classified secret. Because of this, different database access levels have been developed.

The SHAREM database description and data dictionary can be found in appendix B.

C. AIREM

The Air Effectiveness Measurement program was developed to provide the Chief of Naval Operations (CNO) with an assessment of the effectiveness and performance of air antisubmarine warfare systems [Ref. 5:p. 1-1]. In order to accomplish this task, the AIREM program operates in a structured exercise environment [Ref. 5:p. 1-1].

These exercises are conducted on instrumented ranges with the testing designed to target a specific area, such as a particular system, weapon, or platform [Ref. 5:p. 1-1]. The data collected from the exercises is statistically compared with database information in order to formulate a performance evaluation of the areas being tested. The results of this analysis can then be used to distinguish the strong and weak points of the systems in use, current tactics, crew readiness, and decision aid models. This information is extremely important for Fleet ASW readiness because it can identify problem areas that need correcting and contributes to the establishment of baseline Measures of Effectiveness (MOE) for the different systems [Ref. 5:p. 1-2]. To ensure these requirements are fulfilled, AIREM has a list of principal objectives for the program as follows:

- measure the performance and effectiveness of air ASW combat systems and provide quantified assessments of their capability to perform specified mission functions
- determine the contribution of platform subsystems to overall mission effectiveness
- identify and document deficiencies in current air ASW systems and sensors
- recommend potential solutions to deficiencies and prioritize combat system improvement requirements
- provide a source of data to validate parameters and logic within ASW models

By fulfilling these objectives, AIREM provides a valuable service in improving air ASW effectiveness.

The Air Effectiveness Measurement (AIREM) program database is also organized on a relational database management system. AIREM is an aircraft program only, with very few surface ship asset data fields. Again, the AIREM database allows for the collection and exploitation of the large amount of data produced during aircraft ASW operations and exercises. Areas from which data are collected include:

- administration
- platform equipment configurations
- environmental/acoustic data
- contact information
- attack and tactic information
- command and control

The AIREM database is resident on the ORACLE relational database management system. It was converted from a Pascal based flat file management system in 1986 to facilitate faster and more efficient data queries. The AIREM database utilizes a "top down" data usage approach [Ref. 4:p. 2]. For example, after the data is collected, a statistical summary of the exercise results is formulated and this information is entered into the database [Ref. 4:p. 2]. Typical to relational database management systems, the tables are uniquely identified with primary keys and linked to one another through common attributes called foreign keys. When AIREM was first converted to a relational database management system, the lack of primary and foreign keys was a serious deficiency and had a negative impact on the system's performance. A major revision of the database structure corrected these shortcomings. This subsequently required a revision of the menu display to make it compatible with the new table design and to meet query requirements [Ref. 5:p. 1-6]. The information in the AIREM database is classified secret, therefore in order to meet security requirements, four access levels have been incorporated into the system design. From least to most restrictive, the four levels of access are: 1. query only; 2. update and query; 3. input and query data; 4. unlimited access for overall database administration [Ref. 5:p. 1-7].

The AIREM database description and data dictionary can be found in appendix C.

An overview of the three component databases is provided in Table 1.

TABLE 1 COMPONENT DATABASE SYNOPSIS

	PACER	SHAREM	AIREM
Sponsor	SPAWARSYSCOM	CNO	CNO
Types of information contained	- Target detection - Target localization - Weapon order information - Time of fire - Torpedo performance - Target response	- Sensor performance - Detection, localization, classification performance - Command and Control - Tactics - Weapon performance - Vulnerability to submarine attack	- Sensor performance - System performance - Tactics - Crew readiness - Decision aid model performance
Database Platform	Sybase	ShareBase III	Oracle
Hardware Platform	Sun Work Station	ShareBase Server/8000	Personal computers
Size of Database	*	750 MB**	3 MB**
Classification	Secret	Secret	Secret

* Database size has not yet been determined.

** Present size.

III. COMPARISON OF EXISTING DATABASES

This chapter will examine the schemas of the three databases and identify their commonalities and differences. From this analysis a common database schema can then be devised.

This section will identify semantically similar tables and attributes across the three databases. A listing of the synonym and antonym attributes (attributes from each database that do not have a like counterpart in another database) is provided in appendix D. Specific semantic concepts will be developed so the commonalities of the databases can be understood. With respect to the differences between the databases, tables will be highlighted to demonstrate why they should be included in, or eliminated from, the integrated database.

The SHAREM database is the most extensive of the three and will be used as the baseline. As previously discussed, the three databases can be decomposed into similar general categories, which will serve as the basis for comparison. Entity-relationship diagrams (categories representing the entities) have been developed to demonstrate how the different categories of each database relate to each other. By comparing the PACER diagram, Figure 1, to those of SHAREM and AIREM, Figures 2 and 3 respectively, and the database

descriptions in the appendices, it can be seen that the PACER categories are the most unique. The only categories PACER has in common with SHAREM and AIREM are administration, environment, and platform equipment configuration (Surface PACER only). The PACER tables will fit loosely into the categories similar to those of SHAREM and AIREM, and the comparison will be discussed in this context.

A. ADMINISTRATION

The type of information contained in this section is exercise identification numbers, location, dates, objectives, participants, and type of exercise. Table 2 provides a listing of the tables for each database's administration section. Figures 1 through 3 show that the administration portion of each database provides similar information. The primary difference between the different databases is the amount of data collected for each participant. AIREM and SHAREM require more location and event time information than does PACER. As seen in appendix D, AIREM and SHAREM have multiple attributes with similar meaning to single PACER attributes. One reason is that the PACER database is based on *time of fire* and requires less time information than the other databases. All three databases provide for multiple participants, but SHAREM is the only one that supports their full integration into data analysis and reconstruction by

TABLE 2 ADMINISTRATION TABLES

PACER	
General Information	Information on participants and exercise
Ship Information	Ship ID information
Narrative	Description of exercise events
SHAREM	
Exerid	Dates, area, purpose of exercise
Event	Types and times of events conducted
Abstract	Exercise overview, general notes
Objectives	Intentions for MOE's/overall goals
AIREM	
Exercise	Exercise and participant descriptions
Expendables	Expendables use and failure
Event Time	Times of discrete ASW mission events
Deficiencies	Narrative of exercise deficiencies

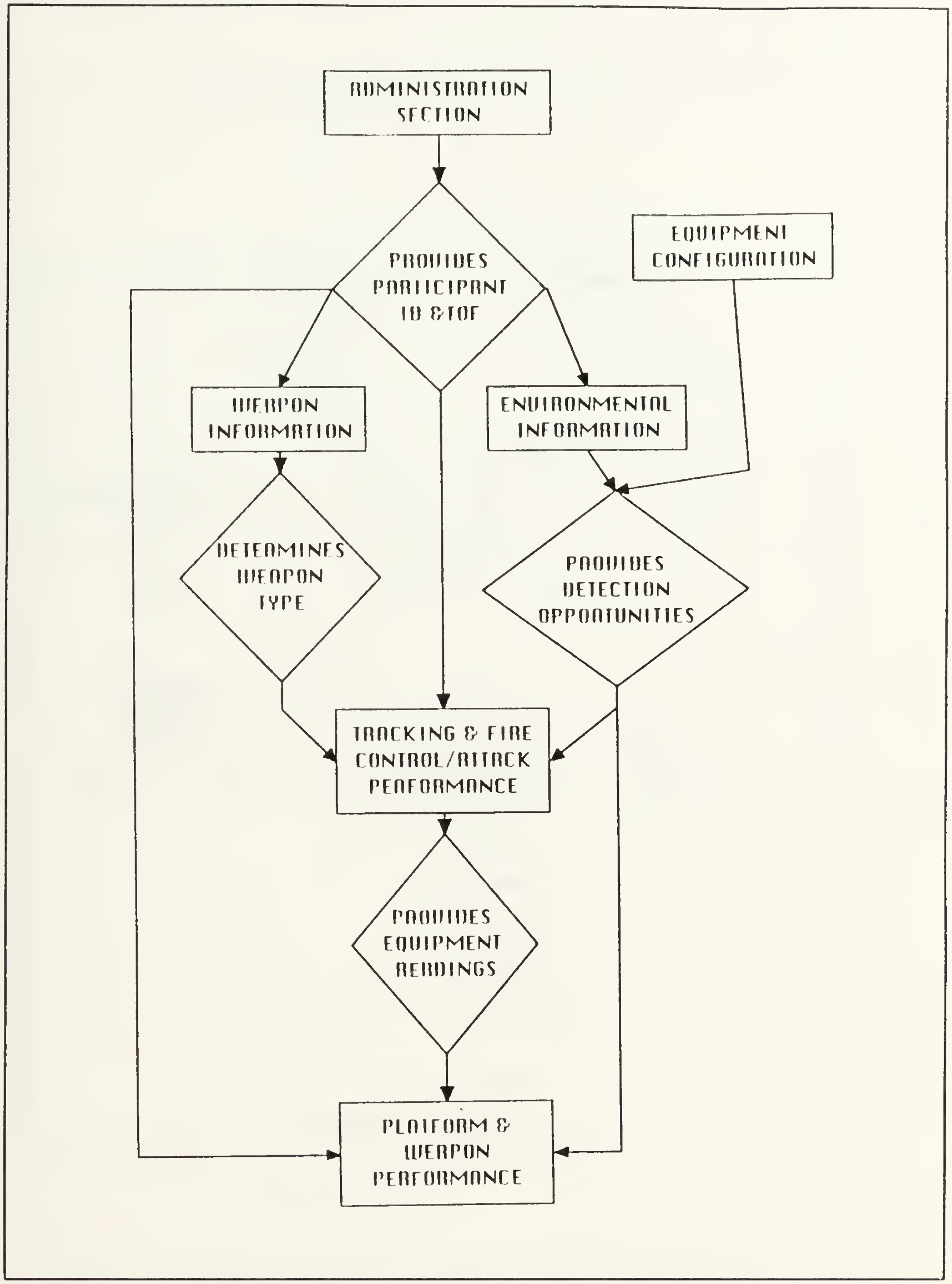

Figure 1 PACER Entity-Relationship Diagram

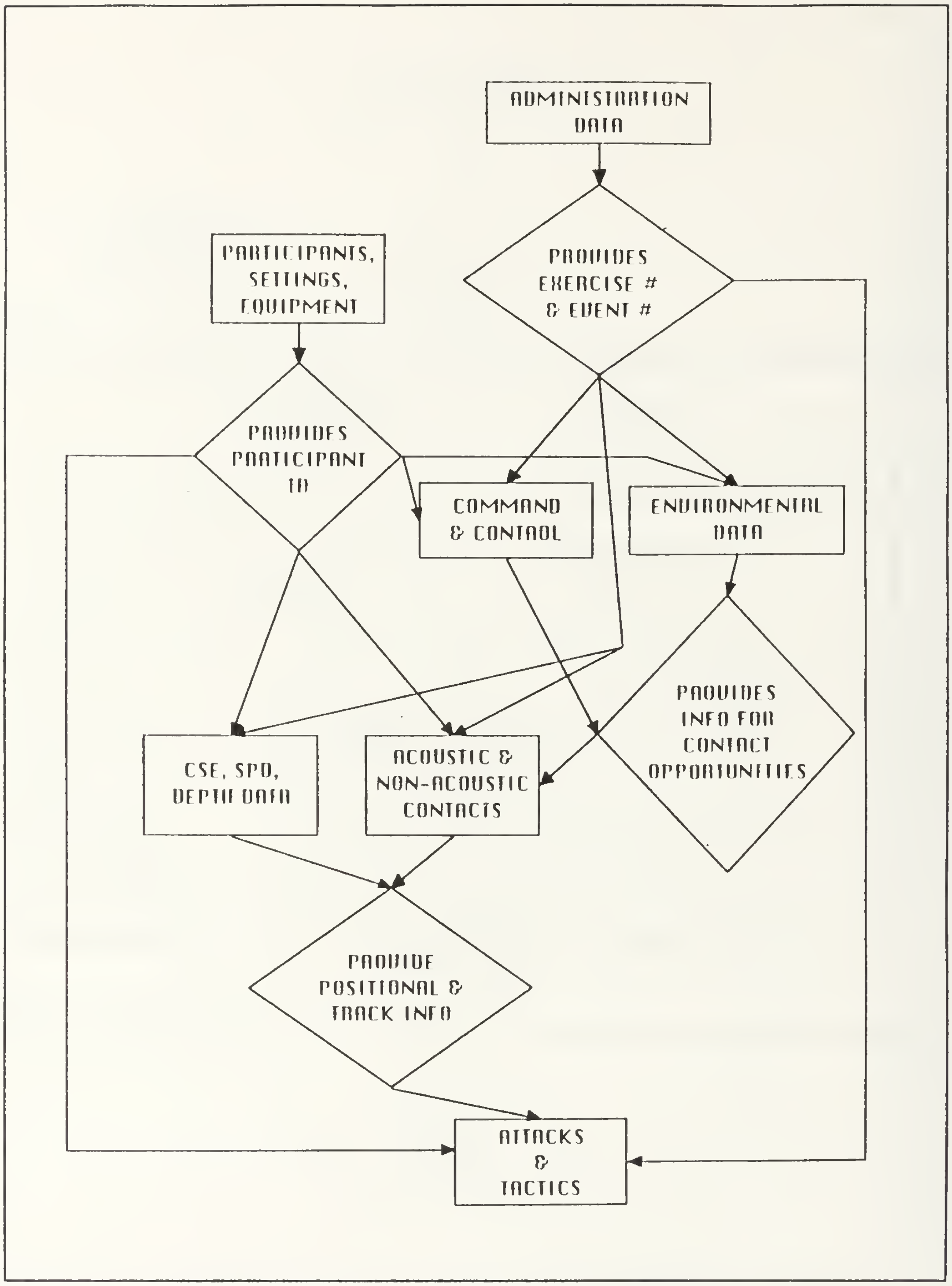

Figure 2 SHAREM Entity-Relationship Diagram

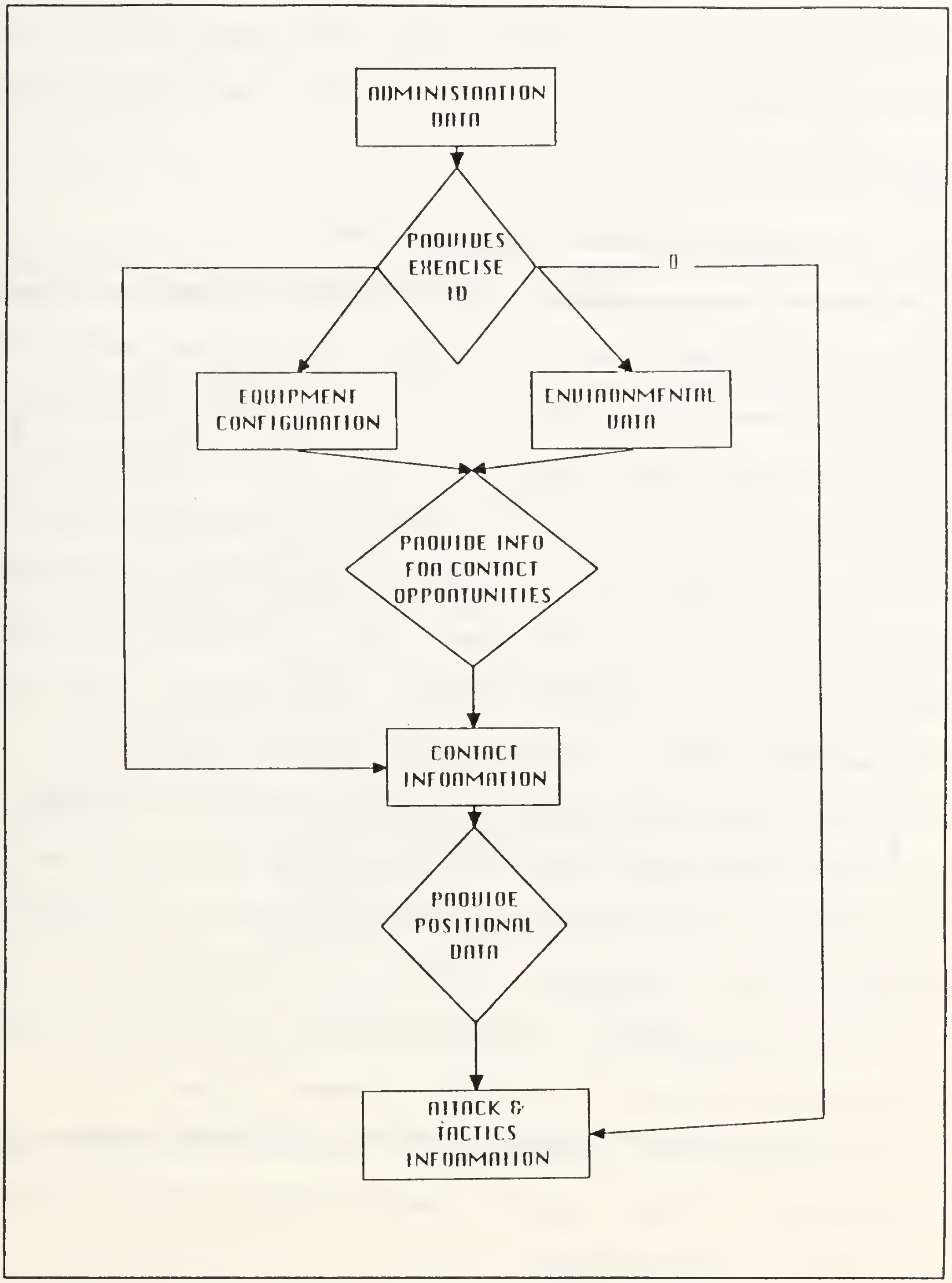

Figure 3 AIREM Entity-Relationship Diagram

providing all participants with individual identification codes. PACER and AIREM only allow for a listing of additional participants.

B. PLATFORM EQUIPMENT CONFIGURATIONS

This is an area of wide disparity across the three databases. AIREM and SHAREM tables are similar pertaining to what equipment is on what platform, but only SHAREM provides for different equipment settings and changes in those settings. Table 3 provides a listing of these tables for each database. Referring to Figures 1 through 3, this segment provides basically the same type of information to the database in all three cases. Once again, the primary difference lies in the amount of data collected. PACER provides basic equipment identification and sonar modes, AIREM provides the same plus the operating status, and SHAREM provides all this plus detailed descriptions of all operating modes of the equipment. This is evident in the synonym portion of appendix D. AIREM however, does allow for aircrew information, which the other databases do not.

In this case, SHAREM again provides the most complete collection of data and will provide the baseline tables for the integrated database.

TABLE 3 PLATFORM EQUIPMENT CONFIGURATION TABLES

PACER	
Tube/launcher Information	System ID and performance data
Fire Control Information	System ID and performance data
Sonar Information	System ID and performance data
Weapon information	Torpedo ID and performance data
SHAREM	
Pident	Alias coding for SHAREM participants
Partic	Participants in each SHAREM exercise
Particeq	Sonar suites and special equipment
Sonrmode	Sonar operating mode changes
Subaugm	Augmentation frequencies and levels
Subspl	Beartrap data on exercise submarines
Subexpos	Audible/visual submarine events
AIREM	
Aircraft Fitment	Types of airborne equipment
Crew & Equipment	Airborne equipment operational status and assessment of aircrew proficiency

C. ENVIRONMENTAL AND ACOUSTIC DATA

All the databases have similar table and attribute design for this category of data. The AIREM and SHAREM systems, however, do provide a more extensive and complete package as seen in Table 4. The similarities include maximum predicted and observed ranges, layer depth, wind, and sea state.

TABLE 4 ENVIRONMENTAL AND ACOUSTIC DATA TABLES

PACER	
Acoustic Information	Range, sea state, bottom data
SHAREM	
Weather	As recorded by participants
Btsvploc	Locations of participant BT drops
Btsvdata	BT data collected during exercise
Actrng	Active range predictions of ships
Passrng	Passive range predictions of ships
AIREM	
Environmental	Environmental exercise conditions
Acoustic Predictions	Predicted detection ranges
Ambient Noise	Measured ambient noise

The PACER database does not contain the ability to record weather, target acoustical information, or in depth range data. AIREM does not contain the ability to enter convergence zone or bottom bounce characteristics. SHAREM does not address ambient noise or electromagnetic ducting in its environmental tables. These are important capabilities in

order to understand the complete environmental/acoustic picture and will be included in the consolidated database.

D. CONTACT INFORMATION

All the databases allow for the target's course, speed, depth, bearing, and range as shown in appendix D. A listing of the tables associated with contact information is provided in Table 5. AIREM and SHAREM provide these capabilities plus much more. These two databases allow for both acoustic and non-acoustic detection/tracking data to be collected. They also provide for the collection of acoustic information, detection opportunities that may have been missed, and a crew's ability to correctly classify and track a contact. These capabilities are essential in order to monitor the performance of ship and aircraft crews. As mentioned earlier, PACER is concerned primarily with fire control and attack performance (as portrayed in Figure 1), and that is why contact management information is limited to just the necessities.

A difference between the AIREM and SHAREM track data is AIREM uses track information that has been computed from the different sources and averaged, while SHAREM inputs the raw data from all the sources and then has the system calculate the tracks to compare and analyze the differences. In the consolidated database, average values are not input but can be derived if necessary.

TABLE 5 CONTACT INFORMATION TABLES

PACER	
Tracking & Attack Performance Summary	Fix, course/speed, buoy, and range assist information
Analysis Summary	Tracking performance information
SHAREM	
TIMS8	Active sonar contacts
TIMS24	Passive sonar contacts
TIMS30	Sonobuoys deployed, dip data
TIMS31	Air attack, dips, visual, etc.
TIMS5	Ship radar and visual contacts
TIMS9	ECM and ESM contacts
AIREM	
Target Profile	Acoustic characteristics of target
Detection	Target detection and classification data
Classification Summary	Classification success data
Bearing & Range Error	Aggregate data for sensor bearing and range errors

E. ATTACK AND TACTICS INFORMATION

All the databases have good attack information capabilities, and a listing of these tables are furnished in Table 6. Each one, however, emphasizes a different area. PACER stresses a platform's fire control system and the weapons' performance. This is clearly illustrated in Figure 1. It collects extremely specific data of all settings and outputs to measure the system's effectiveness. AIREM also collects fire control system data, but places more importance on crew performance. The attributes are designed so the data can be used to easily determine crew proficiency. SHAREM is set up to measure only the success of an attack, placing most of its attention on tactics and countermeasures. As seen in appendix D, there are few similarities between the databases.

These three areas combined into a single database would provide an excellent foundation to perform a myriad of antisubmarine warfare analysis tasks. This is the type of information that is needed in order to draw the most accurate conclusions possible on all aspects of ASW readiness, including material readiness, crew proficiency, and soundness of current doctrine.

F. COMMAND AND CONTROL

SHAREM is the only database that has any sort of command and control capability, incorporating both Integrated Undersea

TABLE 6 ATTACK & TACTICS INFORMATION TABLES

PACER	
Weapon Drop Parameters	Target and aircraft course/speed and positional data
Weapon Drop Parameters Circle	Firing information for circle search torpedo
Weapon Drop Parameters Snake	Firing information for Snake search torpedo
Aircraft System Performance Summary	Navigation system performance data
Error Tree #1	Torpedo miss and localization errors
Error Tree #2	Aircraft course/speed and positional errors
Error Tree	Fire control, target evasion, and localization errors
ASROC Analysis Summary	System orders and setting data
Tube Analysis Summary	System orders and setting data
Drop Information	Aircraft fire control data
SHAREM	
Srfcm	Ship countermeasures employed
Subcm	Submarine countermeasures employed
Wpncmdet	Weapon countermeasures detected
TIMS11	Ship attacks
Tracks	Participant movements
Intertgt	Ranges and bearings between units
AIREM	
Localization	Data on localization tactic and sensor used, and success of localization attempt
Fix & Track Accuracy	Fix and track errors for sensors used, with sample sizes of statistics
Tracking Performance	Target tracking performance as percentage of contact hold time
Attack Performance	Aircraft, target, and weapon splash data for actual weapons drops

Surveillance System (IUSS) cuing and tasking. This is just one more step in creating a database that can provide a measure of effectiveness for the entire ASW process. SHAREM collects information on the effectiveness of the cuing and communications. This type of information should allow Sound Ocean Surveillance System (SOSUS) and Surface Towed Array Sonar System (SURTASS) to eventually play a more tactical role in the future of antisubmarine warfare.

IV. INTEGRATED DATABASE CONSTRUCTION

There are two principal concerns in creating an integrated database: 1. insuring that all the necessary data and data relationships are still present for the required reconstruction; 2. insuring that the exercise objective measures of effectiveness remain satisfied. The first step in designing a new database is to create the schema for that database. The schema for the integrated database must include all relationships from the three original databases, and also allow for new relationships resulting from the integration. The new database schema was loosely modeled after the SHAREM database, with requisite changes and additions made to fulfill the requirements from the other databases. SHAREM was adopted as the baseline because it has the most comprehensive schema of the databases investigated. A database outline and data dictionary is provided in appendix E.

In order to take advantage of the power of available hardware and software, and to minimize the amount of data manipulation prior to data entry, the "bottom up" data usage approach is used. The database is divided into two principal components: the actual working database and the supplementary tables which facilitate data entry. The working database tables are the relational tables, reduced to third normal form and containing one or more primary keys. Due to the size of

the database and the complexity of data relationships, most of the tables have a composite key which is multiple attributes combined to form the primary key [Ref. 6:p. 181]. The tables in the information segment of the database are not designed or required to follow any format criteria. These tables do not support any relational requirements and the data is permanent, updated only if there is a change in a data field definition. Some important factors built into the new database are: security access levels, data entry help and fill lookup tables to assist in the proper data field entries, value constraints to ensure only correct values are entered into the tables, and a menu system to make working with the database as user friendly as possible. There are four access levels built into the system:

- query only
- update and query
- enter and query
- unlimited access providing for overall database administration

These access levels fulfill all the database security requirements. The data entry help and fill lookup tables ease data entry by providing the correct entry choices for the user with the push of a button. This feature not only aids data entry, but also system integrity because it ensures only values from the proper domain are recorded. Another feature

supporting data integrity is the ability to place data constraints on specific fields. In this database design all fields requiring a one letter response (i.e. y-yes, n-no, h-hit, f-freeplay, etc.) have constraints placed on them allowing only the proper responses to be entered. The difference between data constraints is that data constraints are placed on fields requiring an abbreviated version of an entry (y for yes), while the help and fill tables provide letter or number codes for more complicated entries (2 for torpedo problem). Another facet of this design to enhance user friendliness is using the Paradox programming application language to develop a menu driven environment. This aspect of the design simplifies the man-machine interface, enhancing the ease of data entry and manipulation.

The relational portion of the database contains 35 tables informally divided into six categories. The six general areas are:

- administration
- platform equipment configurations
- environmental/acoustic data
- contact information
- tactics and attack information
- command and control

An entity-relationship diagram (with category acting as an entity) is provided in figure 4, and a detailed discussion of the database's tables, broken down by section, follows.

A. ADMINISTRATION

The tables in this section contain all of the administrative information pertaining to an ASW exercise. In the integrated database, there are seven tables to handle this information. The type of information found in these tables is exercise numbers, names, dates, and locations, descriptions of events during an exercise, a description of the exercise and its objectives, and information about the participants. Also included in this section is a table containing PACER specific information such as the PACER coordinator, debrief date and site, and the PACER site. In this section, three of the attributes that will be used as primary keys, or components of composite primary keys, are defined. These attributes are; *exid*, the exercise identification number, *event*, the number of a specific event during an exercise, and *pid*, the alphanumeric identification code to each participant. Another attribute frequently used as part of the primary key is *jtim*, the julian date and time. These four attributes are the most commonly used primary keys; others will be discussed as they are encountered.

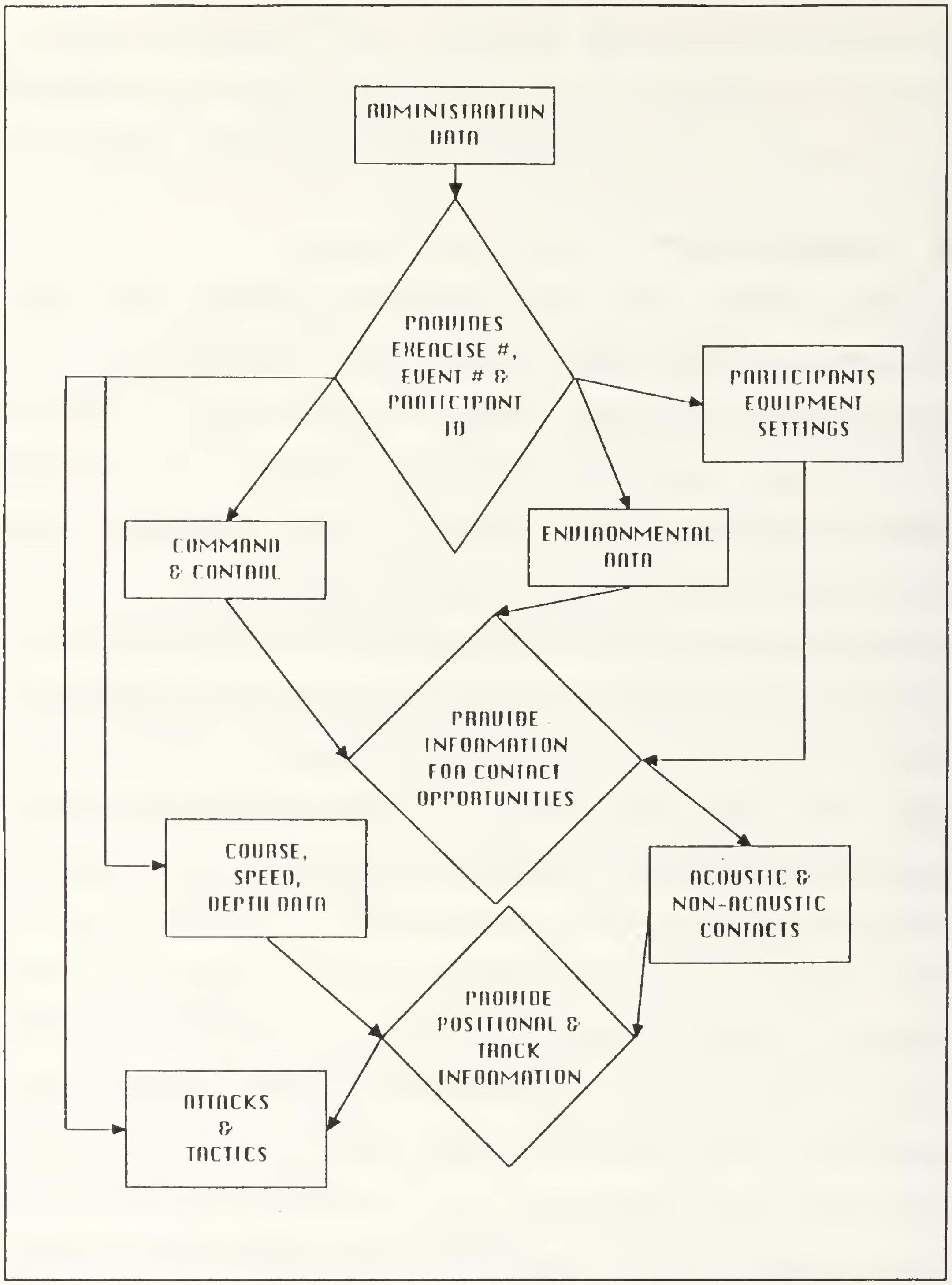

Figure 4 Integrated Database Entity-relationship Diagram

B. PLATFORM EQUIPMENT CONFIGURATIONS

This portion of the database encompasses a broad area including what equipment is carried by each of the participants, and how that equipment is configured. It also contains information on noise generated and noise sources of the participants. This segment contains seven tables. Because a participant can have several pieces of equipment operating at the same time, or there may be more than one source for a received signal, *exid*, *event*, *pid*, and *jtim* do not uniquely identify a particular happening. In these cases another attribute is needed, such as the equipment type (*eqtype*) or the noise source (*source*). Again, due to the complexity and quantity of the data and tables, composite primary keys are the norm.

One table that requires further mention is **AIM_II**. This is a new table in the SHAREM database, whose uniqueness requires its inclusion in the integrated database. This table contains data read directly from a tape recorded from shipboard equipment. The importance of this table is that during reconstruction, personnel performing the analysis can simulate equipment configurations different from the ship's to study the effects [Ref. 7]. This will help in training personnel how to optimize their equipment to meet different situations.

C. ENVIRONMENTAL/ACOUSTIC DATA

This portion of the database consists of six tables that contain information on the weather, sound velocity profiles, acoustic ranges and propagation paths, and bathymetric properties. In the original databases, PACER placed little importance on environmental information (one table of limited data) compared with AIREM and SHAREM. In the changing arena of anti-submarine warfare, environmental and acoustic information is becoming more and more important. As submarines get quieter, and with the reemergence of the diesel threat, knowledge of how sound travels through the water and how it is affected by environmental phenomena could provide the deciding edge in successful undersea prosecutions. In the passive and active range tables, the type of sonar (*sonr*) for which the predictions are calculated must be included as part of the primary key because a particular unit can have multiple systems deployed. Also in the ambient noise table the frequency of interest (*freq*) must be included in the primary key because the ambient noise level changes for different frequencies.

D. CONTACT INFORMATION

This segment of the database contains six tables detailing acoustic and non-acoustic contacts and own unit movements. In this portion of the database, tracks are reconstructed and analysis conducted to determine how well a particular unit

tracked a contact by comparing the track submitted by the contact itself to the track submitted by the unit holding contact. Also, this portion provides the information for determining whether an exercise participant correctly classified its contacts. Due to software limitations of this study, this analysis will be assumed to function properly. The contact number attribute (*contnum*) is required as part of the primary key because a participant may be holding multiple contacts. The contact number, in concert with *exid*, *event*, *pid*, and *jtim* is the only way to uniquely identify a particular contact.

The Tactical Information Management System (TIMS) is introduced in this section . TIMS is a Navy wide system used to collect a myriad of data across multiple areas, of which ASW is just a small portion. Of the three databases, SHAREM is the only one providing information to TIMS. This requirement was incorporated into the integrated database in order to continue supplying the Navy's tactical database with ASW information. The TIMS tables were left virtually untouched with only a couple of exceptions. The first and most drastic change is in table **TIMS30**, aircraft buoy and dipping sonar information. This table does not provide enough data fields to encompass the information provide by AIREM and Air PACER exercises. To prevent having two tables with redundant data, this table was modified to include contact numbers and status, frequency information, and bearing and

range information. The next change was to combine **TIMS5**, non-acoustic contacts, and **TIMS9**, ESM/ECM contacts, into table **TIMS5&9**. These two tables contain the same information and data fields, with the only difference being the contact number. The elimination of this redundant table will not affect the operation of the database.

E. TACTICS AND ATTACK INFORMATION

The eight tables in this segment of the database contain information pertaining to tactics used, types of attacks carried out, fire control system and weapon performance, and countermeasure deployment and effectiveness. An attack is evaluated by comparing the attacking units fire control solution of target course, speed, and position to the actual data submitted by the attacked unit. Through careful analysis and reconstruction, conclusions can be reached concerning a crew's proficiency and tactics, the performance of a unit's fire control system, and the performance of a weapon. With the "bottom up" database system, this analysis can be derived using existing data element values, instead of pre-calculating results by hand and entering only them into the database, as in a "top down" approach. Both PACER and SHAREM employ this approach, taking advantage of the computational power available, whereas AIREM requires some reconstruction and statistical analysis prior to entry of information into the database.

This section of the database provides the most important information for studying the different aspects of ASW. It is here that new tactics can be tested and developed, deficiencies in fire control systems and weapons and possible solutions identified, and strong and weak aspects of current doctrine recognized. The effectiveness of countermeasures against weapons and weapon systems are also evaluated in this section. As in the contact information section, contact number is utilized in the primary key. A new attribute *apid*, the attacking units *pid* is used in place of *pid* in formulating the primary key.

F. COMMAND AND CONTROL

With shrinking resources and improvements in quieting technologies, the days of conducting anti-submarine warfare without relying heavily on the IUSS community are over. In the past the SOSUS was its own entity, collecting acoustic intelligence and providing very general cuing information. In the modern era of detecting and prosecuting undersea contacts, all available assets must be brought to bear in a timely manner to ensure success. To this end IUSS must be incorporated into ASW exercises and their participation evaluated. The only database to incorporate IUSS in its data collection and evaluation effort is SHAREM. The importance of SOSUS and SURTASS information cannot be overemphasized, and the only way to improve their participation in the tactical

picture is through training. The best way to evaluate training is through data collection and exercise reconstruction to identify both positive aspects and areas that need correcting. The new integrated database incorporates information pertaining to the role IUSS plays in undersea contact prosecution. The types of information collected are types of reports sent, the area of uncertainty (AOU) geometry, AOU location, and target classification. The primary key for this table is composed of *exid*, *event*, and the message date time group (*msgdtg*).

G. DATAFILL TABLES

The remaining portion of the database is dedicated to tables providing semantic integrity constraints for specific relational tables. The purpose of this type of table is to provide correct number or letter codes for data fields. These tables can be accessed during data entry to assist the user in entering the proper values. For example, for the *sonr* data field in the **sonrmode** table, if the user is unsure of the proper entry he/she can call up the **sonr** table and the correct responses will be provided. These tables are provided for the data fields requiring number or letter codes, number codes, or abbreviations for lengthy entries.

V. INTEGRATED DATABASE OPERATION

Once the integrated database has been constructed, it must be able to meet the data query and operational requirements of each of the individual databases. The new database must also be accessible at the respective remote sites, but still contain information from all three sources. This chapter is divided into two parts, the first explaining how the integrated database handles the query requirement and produces reports, and the second explaining why this needs to be implemented as a distributed database system.

A. DATA ANALYSIS

PACER, SHAREM, and AIREM all have their own data manipulation and analysis requirements. Although there are some differences in these requirements, for the most part they are similar and can be easily integrated. In fact, a combined database will provide the ability to conduct expanded and more comprehensive analyses as shown in the following sections.

1. Analysis Objectives

As previously mentioned, the three original databases collect basically the same type of information and produce similar data output. The advantage of the integrated database is the ability to provide more comprehensive information due to an increase in the amount of data collected. The eight

analysis objectives of SHAREM subsume those of the other two databases, and therefore will be used here [Ref. 2:p. 3]:

- measure the detection effectiveness of acoustic and non-acoustic sensors
- measure the contact classification effectiveness of acoustic and non-acoustic sensors
- measure the accuracy and timeliness of ASW localization procedures and tactics
- measure the effectiveness of ASW attack procedures, weapons, and tactics
- evaluate the effectiveness of ASW command, control, communications, and intelligence (C3I) and data fusion in task force ASW operations
- measure the vulnerability-to-detection and vulnerability-to-attack of units operating singly or in groups under various conditions of Emission Control (EMCON) and ship quieting
- measure the material readiness of ASW systems and the effectiveness of maintenance procedures available to ship's force
- evaluate the ability of ASW forces to exploit the environment during task force ASW operations

These eight objectives will be discussed in the context of measures of effectiveness, analytical techniques, and the methods of displaying analysis results. The following information was obtained from [ref. 2] and [ref. 5].

a. *Objective 1: Detection Effectiveness*

While most objectives are measured by statistical analysis, sensor detection effectiveness is determined through probability. This is because a search for a submarine does

not rely on detecting every signal, but on maximizing the chances of at least one detection. This probability of at least one detection is how detection effectiveness is quantified. There are two measures of effectiveness (MOE's) associated with detection effectiveness. The first is the probability of detection/no-detection at the closest point of approach, also called lateral range data, and the second is the cumulative probability of detection as a function of range for closing targets.

To conduct the analysis to calculate these MOE's, several tables must be queried to provide the necessary information, and these are listed in table 7. The process

TABLE 7 DETECTION EFFECTIVENESS QUERY TABLES

TIMS8	Active sonar contacts
TIMS24	Passive sonar contacts
TIMS30	Deployed sonobuoy/helo dip data
TIMS5&9	Non-acoustic contact data
Sonrmode	Sonar operating mode changes
Aim_II	Sonar equipment configuration
Tracks	Participant movements
Intertgt	Ranges and bearings between units

occurs as follows:

1. Access **event** table to provide detection events.
2. Access appropriate TIMS table from contact information

section. This table will provide target detection information.

3. Access **sonrmode/aim_ii** tables for equipment operating modes. This information is used to assess a unit's potential for detecting a possible target.

4. Access **tracks** and **intertgt** tables. This information will furnish sensor to target geometries, which coupled with sensor operating mode data, provides detection opportunities resulting from closest point of approach ranges.

Lateral range detection information can be obtained from contact data or raw contact range data. This information can then be plotted as probability of detection verses lateral range, or lateral range plots. Probability of detection is found in different, user-defined range bins by dividing the number of detections by the number of detection opportunities. Lateral range curves assume the submarine is travelling on a constant course at a constant depth.

The cumulative probability as a function of range for closing targets also utilizes user-defined range bins. In this case, a detection opportunity arises when the target moves into a range bin, having not been previously detected. Probability of detection is again found by dividing the number of detections by the number of detection opportunities, and

the cumulative probability of detection is found from Equation (1):

$$P_{(R \geq X)} = P_{(R>X)} + (1-P_{(R>X)}) * (P_{(R=X)}) \qquad (1)$$

Cumulative probability of detection also assumes the submarine's closest point of approach results from it maintaining a constant course and constant depth.

The overall probability of detection is found by calculating the probabilities of detection in the different range bins for the individual sensors and applying Equation (2):

$$P_d = 1 - \prod_{i=1} (1-P_{di}) \qquad (2)$$

In order to provide a graphical output, the probability of detection is displayed as lateral range curves, one for each sensor, and the cumulative probability of detection is plotted against range to also form a curve.

b. Objective 2: Classification Effectiveness

Classification effectiveness provides a measure of the ability of equipment and personnel to correctly determine the validity of a contact. Once contact is gained there are only four possible outcomes as illustrated in Figure 5; it is valid contact and it is a submarine (quadrant a), it is valid

contact but not a submarine (quadrant b), an invalid contact and there is a submarine in the vicinity (quadrant c), and it is an invalid contact with no submarine in the area (quadrant d). There are two MOE's associated with classification effectiveness. The first is the probability a contact is classified POSSUB or higher is a valid submarine contact, and the second is the probability that a valid submarine contact will be correctly classified POSSUB or higher.

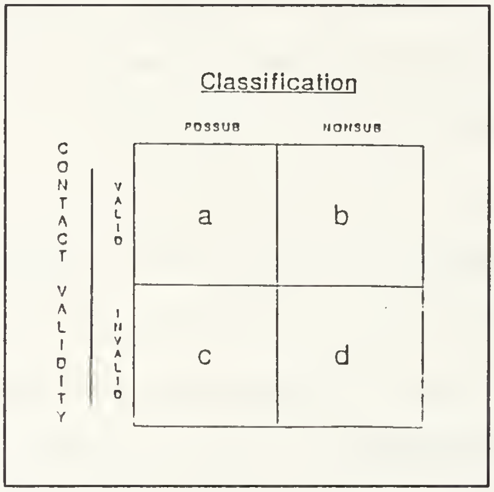

Figure 5 Classification Effectiveness Grid

Classification information is provided from the **TIMS8**, **TIMS24**, **TIMS30**, and **TIMS5&9** tables of the database via the following steps:

1. Detection information is determined as described above.
2. Access contact information tables to obtain target classification information.

3. Access **tracks** table to compare possible detected targets to actual target tracks to determine classification validity.

A listing of the tables used in this analysis is furnished in Table 8.

In order to evaluate classification effectiveness a two by two grid such as in Figure 5 must be constructed for each sensor. For the first MOE, this probability is found by dividing the number of valid POSSUB classifications by the total number of POSSUB classifications. In Figure 5 this is quadrant a divided by the combination of quadrants a and c. For the second MOE, this probability is found by dividing the total number of valid contacts classified POSSUB by the total number of valid contacts. In Figure 5, this is quadrant a divided by the combination of quadrants a and b.

Classification effectiveness data can be displayed in the two by two grids, a different grid for each sensor. As for the MOE's, the probabilities are displayed on a bar chart for each sensor.

c. *Objective 3: Localization Effectiveness*

The time between target detection, correct classification, and localized to attack criteria is the procedure known as localization. In order to measure localization effectiveness two criteria must be explored, the probability localization is successful, and if successful the

time required to localize. For the complete analysis of objective three, localization ineffectiveness must also be

TABLE 8 CLASSIFICATION EFFECTIVENESS QUERY TABLE

TIMS8	Active sonar contacts
TIMS24	Passive sonar contacts
TIMS30	Deployed sonobuoy/helo dip data
TIMS5&9	Non-acoustic contact data
Tracks	Participant movements

looked at, including the probability that localization will not be accomplished prior to the accomplishment of the submarines mission or the probability of wasting time prosecuting false contacts. These four criteria are the MOE's associated with objective three. The tables associated with these MOE's are provided in table 9.

A successful localization occurs when a target is detected, properly classified, and its position refined to achieve attack criteria. Localization analysis occurs as follows:

1. Obtain validated detection and classification data as described in the previous two sections.

2. Access **TIMS31** or **TIMS11** for aircraft or ship attack information respectively, along with target positional data (positional data includes range, bearing, lat/long, time, etc.).

3. Access **allatks** table for additional target positional data.

4. Access **sup_atk** for launch platform positional data.

5. Access **tracks** table to obtain actual target positional data.

6. Compare this information and determine the tracking/localization errors.

To find the probability of successful localization divide the number of successful localizations by the total number of initial detections. The time required to localize is defined in terms of overall localization delay and significant localization delay. The time period between initial detection and localization to attack criteria is the overall localization delay, and the time period between the first contributing detection and localization to attack criteria. Determining the probability of localizing prior to the completion of the submarines mission is accomplished by dividing the number of these localizations by the total number of successful localizations. The probability of wasting time prosecuting false contacts is found by dividing the number of false contacts on which localization was attempted by the number of invalid contacts improperly classified. The above results are displayed as bar charts, with the sensors presented along the x-axis and the probability/time presented on the y-axis.

TABLE 9 LOCALIZATION EFFECTIVENESS QUERY TABLES

TIMS8	Active sonar contacts
TIMS24	Passive sonar contacts
TIMS30	Deployed sonobuoy/helo dip data
TIMS5&9	Non-acoustic contact data
TIMS31	Aircraft attack information
TIMS11	Ship attack information
Sonrmode	Sonar operating mode changes
Aim_II	Sonar equipment configuration
Tracks	Participant movements
Intertgt	Ranges and bearings between units
Allatks	Attack information
Sup_atk	Additional fire control system information

d. *Objective 4: Attack Effectiveness*

Measuring the effectiveness of ASW attack procedures, weapons, and tactics must be approached from a conditional probability viewpoint. Because a large number of attacks are simulated, this analysis depends heavily on statistical data resident in the database, collected and calculated from previous exercises. The two measures of effectiveness associated attack effectiveness are the probability ASW attacks are successful and probability enemy submarines are successfully attacked.

Analysis of attack effectiveness occurs as follows:

1. Determine target detection, classification, and localization as previously discussed.
2. Access weapon track geometry from **tracks** table.
3. Access **wpn_fire** table for fire control system solution information and weapon identification and performance data.
4. Access **subcm** and **wpncmdet** for countermeasure information. This data is used to determine countermeasure effectiveness by comparing it to the hit/miss data found above, and also determine an attacking units ability to overcome countermeasures.

The fire control solution data is readily obtainable from the firing unit for either actual or simulated firings. However, for a simulated launch, the weapons performance and the hit/miss data must be obtained by statistical reconstruction

using data stored in the database. A listing of the tables queried in this section is furnished in Table 10.

To calculate the probability of a successful attack, Equation (3) is used.

$$P_{KILL} = \{(P_F)*(P_V)*(P_{SAT/V})*(P_{HIT/F/SAT/V})\} * (P_{KILL/HIT}) \quad (3)$$
$$+ \{(P_F)*(P_V)*(P_{UNSAT/V})*(P_{HIT/F/UNSAT/V})\} * (P_{KILL/HIT})$$

Where:

P_F = Probability that weapon functions properly.

P_V = Probability that weapon is fired at valid contact.

$P_{SAT/V}$ = Probability weapon placement is satisfactory given it was fired at a valid contact.

$P_{HIT/F/SAT/V}$ = Probability that weapon achieves an exercise hit given that it functions properly, fired at a valid contact, and satisfactorily placed.

$P_{UNSAT/V}$ = Probability weapon placement is unsatisfactory, given it is fired at a valid contact.

$P_{HIT/F/UNSAT/V}$ = Probability that weapon achieves an exercise hit given that it functions properly, fired at a valid contact, but is unsatisfactorily placed.

$P_{KILL/HIT}$ = Probability that weapon achieves a kill or mission abort given that it achieves a hit.

To calculate the probability that enemy submarines are successfully attacked, a maximum vulnerability range must

first be established around the high value unit. Then only the submarines that enter this zone will be considered in the following equation.

$$P_{KILL} = \{(P_D)*(P_C)*(P_L)*(P_{AS})*(P_F)*(P_{HIT/F/AS})\} * (P_{KILL/HIT}) \quad (4)$$
$$+ \{(P_D)*(P_C)*(P_L)*(P_{AU})*(P_F)*(P_{HIT/F/AU})\} * (P_{KILL/HIT})$$

Where:

P_D = Probability that submarine is detected.

P_C = Probability that submarine is correctly classified.

P_L = Probability submarine is localized to attack criteria.

P_{AS} = Probability weapon placement is satisfactory.

P_F = Probability weapon functions properly.

$P_{HIT/F/AS}$ = Probability weapon achieves an exercise hit given it functions properly and is satisfactorily placed.

P_{AU} = Probability weapon placement is unsatisfactory.

$P_{HIT/F/AU}$ = Probability weapon achieves an exercise hit given it functions properly but is unsatisfactorily placed.

$P_{KILL/HIT}$ = Probability weapon achieves a kill or mission abort given it achieves a hit.

This data is also presented in bar chart format. Each of the contributing factors are plotted along the x-axis while their values are plotted along the y-axis. A different chart is prepared for each target, launch mode, and so forth.

e. *Objective 5: C3I Effectiveness*

C3I was incorporated into the consolidated database because it plays a vital role in ASW prosecution. Analysis in the area of C3I is mostly subjective in nature, with communications reliability the only area that can be objectively measured. There are four MOE's pertaining to C3I effectiveness and these are; probability that communications attempts are successful, availability and accuracy of locating data, percentage of significant decisions to the ASW problem that are the correct decisions, and the number of occasions resource management have a significant impact on ASW effectiveness.

The only information required from the database in this case are the track geometries for all the participating units, and these are determined as described above, and provided in Table 11. The remainder of the necessary data is obtained by the analyst from the applicable logs and messages relating to the decision making process.

Determining the probability of successful communication is calculated by dividing the number of successful attempts by the total number of communication attempts. In determining the availability and accuracy of locating data, an accuracy constraint must first be determined by the participant commanders. Then the analysts calculate the percentage of time locating data is available, and if

TABLE 10 ATTACK EFFECTIVENESS QUERY TABLES

TIMS8	Active sonar contacts
TIMS24	Passive sonar contacts
TIMS30	Deployed sonobuoy/helo dip data
TIMS5&9	Non-acoustic contact data
TIMS31	Aircraft attack information
TIMS11	Ship attack information
Sonrmode	Sonar operating mode changes
Aim_II	Sonar equipment configuration
Tracks	Participant movements
Intertgt	Ranges and bearings between units
Allatks	Attack information
Sup_atk	Additional fire control system information
Wpn_fire	Weapon system and weapon information
Subcm	Submarine countermeasures employed
Wpncmdet	Weapon countermeasures detected

TABLE 11 C3I EFFECTIVENESS QUERY TABLES

TIMS8	Active sonar contacts
TIMS24	Passive sonar contacts
TIMS30	Deployed sonobuoy/helo dip data
TIMS5&9	Non-acoustic contact data
TIMS31	Aircraft attack information
TIMS11	Ship attack information
Tracks	Participant movements
Intertgt	Ranges and bearings between units
Allatks	Attack information
Sup_atk	Additional fire control system information

available, does it meet the established accuracy constraints. For the analysis of the percentage of correct decisions and the impact of resource management, the analysts are required to make subjective decisions based on all the available from that exercise and past exercises.

As for the previous objectives, the probabilities are displayed in bar charts, with the instances on the x-axis and the probability on the y-axis. The percentage MOE's are presented in pie charts.

f. Objective 6: Surface Ship Vulnerability

Two aspects of this objective will be discussed separately.

(1) Vulnerability-to-Detection

Analyzing vulnerability to detection is the same as determining detection, except from the submarine's point of view. There are three MOE's instead of two in this case, however, dealing with counterdetection instead of detection. The first two are the probability of counterdetection at the closest point of approach and cumulative probability of counterdetection as a function of range for closing targets. The third MOE is the probability of detection prior to counterdetection.

The information retrieval from the database and analytical methodology of determining the first two MOE's is identical to part (a.) of this chapter. To determine the

probability of detection prior to counterdetection, the sweep width's of the target and searcher must be extracted from the lateral range curves. Then let L/A be the proportion of the search area to the total area and solve the equation:

$$P_{fd} = \lim_{L/A \to 0} \frac{1-e^{-WL/A}}{(1-e^{-WL/A}) + (1-e^{W'L/A})} \quad . \qquad (5)$$

Again, the first two MOE's are presented as described in part (a.) of this chapter. The third MOE is displayed as two curves, one for active search and one for passive, with probability on the y-axis and ship speed on the x-axis.

(2) Vulnerability-to-attack

The principal reason for this area of analysis is to evaluate torpedo defense effectiveness in four different areas. These four areas comprise the MOE's, the probability of detecting antiship torpedoes, the probability of correct classification, the time between launch and detection and distance from target ship at time of detection, and the probability that tactical maneuvers and/or countermeasures are effective. As with attacks against submarines, attacks conducted by submarines are usually simulated and most of the analysis is statistical in nature, relying on models and data resident in the database.

Vulnerability-to-attack analysis is conducted as follows:

1. Obtain detection, classification, and track geometry information for torpedoes in the same manner as previously discussed for targets.

2. Access **tracks** table for tactical maneuvering data.

3. Access **srfcm** table for information on ship deployed countermeasures.

4. Access **wpn_fire** table for hit/miss information.

5. Compare the above information and draw conclusions on a unit's vulnerability-to-attack and the causes.

The methods of determining probabilities are similar to previous computations. The probability of detecting torpedoes is found by dividing the number of torpedoes detected by a ship by the total number of torpedoes fired at that ship. The probability of correct classification is found by dividing the number of torpedoes correctly classified by the number of torpedoes detected. The time and distance of detection and classification can be computed directly from the data. To determine the percentage of times the ship successfully avoided the torpedo, divided the number of avoidances by the number of avoidance attempts.

The data is presented as numbers, timelines and commentary.

g. *Objective 7: Material Readiness*

Analysis that provides information on equipment deficiencies is extremely valuable in pinpointing problems and

TABLE 12 SURFACE SHIP VULNERABILITY QUERY TABLES

TIMS8	Active sonar contacts
TIMS24	Passive sonar contacts
TIMS30	Deployed sonobuoy/helo dip data
TIMS5&9	Non-acoustic contact data
Sonrmode	Sonar operating mode changes
Aim_II	Sonar equipment configuration
Tracks	Participant movements
Intertgt	Ranges and bearings between units
Srfcm	Ship countermeasures employed
Wpn_fire	Weapon system and weapon information

possible corrective actions. The biggest strength of the PACER database lies in its ability to perform this function, specifically with respect to fire control systems, and for that reason these aspects were incorporated into the integrated database. The three MOE's are whether or not the system is operating up to specification, exercise availability of equipment, and the mean time to repair.

Determining whether sonar systems are operating properly is the most difficult attribute to measure. The two methods available are comparing two identical systems operating in the same area, or conducting a standard set of tests on the system and comparing the results to the system

specifications. The tables needed to provide this information are furnished in table 13. Comparing similar systems operating in the same area can be accomplished by comparing their performance results stored in the database, specifically in the tables pertaining to contact information addressed earlier. This is dependent, however, on whether this situation has occurred. Determining the performance of fire control systems is more straightforward. Fire control solution data can be extracted from the database and compared

TABLE 13 MATERIAL READINESS QUERY TABLES

Allatks	Attack information
Sup_atk	Additional fire control system information
Wpn_fire	Weapon system and weapon information

to calculated ideal solutions. Fire control solution information is found in the **allatks**, **wpn_fire**, and **sup_atk** tables of the database. By analyzing differences in these parameters problems can usually be pinpointed and the appropriate action recommended. Computing equipment up time during an exercise is accomplished by dividing system up time by the combination of up time and down time. Mean time to repair is assumed to be log normally distributed, and to calculate use equation (6) where r is the observed repair time

and n is the number of repairs. This information is obtained from maintenance and PMS records instead of the database.

Equipment performance is presented as commentary, while exercise availability of equipment and mean time to repair is displayed in tabular form, broken down by equipment type per participating unit.

$$MTTR = \exp\frac{\{(\ln r_1 + \ln r_2 + \ldots + \ln r_n)}{n} \qquad (6)$$

h. Objective 8: Environmental Factors

Collection of environmental data during exercises, especially in areas of real world interest, provides valuable information during actual operations. Through analysis of the effects of different environmental conditions, the ability to exploit the environment can be enhanced. To provide direction for this analysis three measures of effectiveness have been developed. First is the effect of the environment on detection, classification, localization, and attack effectiveness, second is the degree of which environmental factors are considered in the tactical decision making process, and the appropriateness and timeliness of those decisions, and last is the accuracy and timeliness of acoustic performance predictions.

Shipboard acoustic prediction systems use temperature versus depth information provided by expendable bathythermographs (XBT) to make their calculations. To determine the effects of the environment, the following steps are taken:

1. Determine actual contact range information as explained in parts (a.) through (d.) of this chapter.
2. Access **btsvloc** for location of measurement.
3. Access **btsvpdat** for temperature verses depth data.
4. Access **passrng** and **actrng** tables for shipboard predicted ranges.
5. Compare predicted ranges with actual ranges to determine prediction system accuracy.

Comparing shipboard calculations to non-organic predictions, and interpreting environmentally based decisions are conducted by the analyst with little interface with the database. Logs and messages are generally used to conduct this evaluation. A listing of the tables necessary for this analysis is found in Table 14.

Determining the effect of the environment on ASW effectiveness is dependent on the varying environment itself. The proper approach is to hypothesize what the environmental impact should be, and then seek to either prove or disprove the hypothesis. Once the proof (or falsification) is complete an explanation for the phenomenon can be presented. Tactical doctrine provides for the requirements of updating and proper

utilization of environmental factors. The analyst must ascertain how the commands utilized the environment by quantifying the proportion of events requiring updates to acoustic predictions to those that actually receive prediction updates. Determining if decisions based on environmental factors are appropriate and timely is a subjective process, loosely guided by a ratio of correct decisions to all decisions. To determine the accuracy of acoustic prediction data, comparisons between actual (observed) ranges and predicted ranges must be made. The two methods for conducting this analysis are developing lateral range curves and comparing the predicted 50 percent probability of detection ranges with the observed ranges, and comparing raw contact range data for each sensor to the predicted ranges. Determining the timeliness of acoustic performance predictions is a straightforward procedure of ascertaining the time difference between the time the prediction was prepared for and the time it was actually usable.

The effects of the environment on ASW effectiveness are presented as a series of graphs and charts, similar to those described for the first four objectives, displaying how the environment impacted areas such as detection performance, classification, weapon performance, and so forth. How the environment was considered during the tactical decision making process is presented as commentary.

TABLE 14 ENVIRONMENTAL FACTORS QUERY TABLES

TIMS8	Active sonar contacts
TIMS24	Passive sonar contacts
TIMS30	Deployed sonobuoy/helo dip data
TIMS5&9	Non-acoustic contact data
TIMS31	Aircraft attack information
TIMS11	Ship attack information
Sonrmode	Sonar operating mode changes
Aim_II	Sonar equipment configuration
Tracks	Participant movements
Intertgt	Ranges and bearings between units
Allatks	Attack information
Sup_atk	Additional fire control system information
Wpn_fire	Weapon system and weapon information
Subcm	Submarine countermeasures employed
Wpncmdet	Weapon countermeasures detected
Btsvpdat	Temperature vs. depth data
Btsvloc	Location of XBT drops
Passrng	Passive range predictions
Actrng	Active range predictions

Accuracy of acoustic prediction performance is presented in two different formats, lateral range curves if that approach is used and a difference table if raw contact data is used. The timeliness of this information is presented in tabular format, providing minimum, maximum, mean, and median time differences.

B. DATABASE IMPLEMENTATION

For the integrated database to be effective and useful to current users, it must be accessible at individual program sites and also provide for the data entry and storage at these distributed sites. To achieve this, the new database must be implemented as a distributed database system. A distributed database system connects individual systems, or nodes, so that a user at any node can manipulate the database as if it were a centralized system [Ref. 8]. The alternative is to establish a centralized system with remote access available from the remote sites. This plan has serious drawbacks, however, including slower response times, higher cost, growth limitations, and a decrease in reliability [Ref. 9:p. 2].

The construction of the distributed system calls for the integration of three different database management systems. If the databases were just interconnected and combined there would be numerous problems with data compatibility due to the different data collection and entry methods at each site. For this reason an integrated database was developed. In order to

implement the new database several changes, in some cases drastic changes, must be made to the current database structures. One option is to have the integrated database and the individual sites to utilize a single DBMS. Another option is that each site would maintain its own DBMS, in essence creating a nonhomogeneous distributed database system, thus requiring the development of a software interface. Also, only that portion of the database most frequently needed by each site must be stored there. This will enhance user satisfaction, but it will create data redundancy, which in turn will create difficulties in making updates to the database. A method of synchronizing database updates must be developed to ensure database integrity and continuity are maintained. Once these changes have been incorporated, each user will be able to conduct more in depth analysis due to the increase in exercise data available. The end result of the new database should be more comprehensive reconstruction analysis and an improvement in the conclusions drawn from the information obtained from ASW exercises.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

While the SHAREM, AIREM, and PACER database systems currently provide adequate information for their own specific ASW uses, they are limited in the scope of information which each provide on their own. Since these three databases collect and provide similar information, it seems a natural extension to integrate these systems into a single antisubmarine database. The integration of these databases will be a formidable task, requiring the reconstruction of all three systems, as well as changes to the Tactical Information Management System. However, this integration can provide a more comprehensive utilization of all the detect to engage type of information available.

Another benefit is a decrease in the data collection requirements placed on the participants. Since all three exercises would utilize the same database, the data collection requirements would be the same for each exercise. Other benefits include a standardization of how the data is collected, how the data is analyzed, and how the final product of analysis and reconstruction is presented.

B. RECOMMENDATIONS

The integration of the SHAREM, AIREM, and PACER databases is achievable, using the schema developed in this thesis. There are hardware and software issues that must be resolved, but the technology exists to overcome these obstacles. In fact, with the current atmosphere of streamline and consolidation, the integration of these three databases could be taken a step further to the integration of the three programs. They all provide basically the same type of information, and with the new database, the data manipulation requirements of each program can be accomplished. The integration of the databases and programs would provide a single source dedicated to collecting, analyzing, and interpreting ASW data with the sole purpose of improving all aspects of the detect to engage sequence of undersea warfare.

APPENDIX A

A. AIR PACER ANALYSIS DATA SYSTEM DESCRIPTION

ADMINISTRATION SECTION	CONTENTS DESCRIPTION
General Information	Information on participants and exercise
Narrative	Description of exercise events
ENVIRONMENTAL SECTION	
Acoustic Information	Range, sea state, bottom data
WEAPON SECTION	
Weapon Information	Torpedo ID and performance data
TRACKING AND FIRE CONTROL/ATTACK SECTION	
Tracking and Attack Performance Summary	Fix, course/speed, buoy, and range assist information
Weapon Drop Parameters	Target and aircraft course/speed and positional data
Weapon Drop parameters circle	Firing information for circle search torpedo
Weapon Drop Parameters Snake	Firing information for snake search torpedo
PLATFORM AND WEAPON PERFORMANCE	
Aircraft System Performance Summary	Navigation system performance data
Error Tree #1	Torpedo miss and localization errors
Error Tree #2	Aircraft course/speed and position errors

B. AIR PACER ANALYSIS DATA SYSTEM DATA DICTIONARY

GENERAL INFORMATION

Aircraft ID number
Operations date
Time of fire
Operations type
Exercise location (3D range/location)
PACER Coordinator
Debrief date
Debrief location
Exercise identifier
Pacer site
Range event number
Unit ID/side number
Crew number
Wing

Home base/ship
Number of firing opportunities
Number of other units involved
Sub:__ VP:__ VS:__ HS:__ HSL:__ Surf:__
Controlling unit
Type of control
Run name/report code
Date entered
Date checked

ACOUSTIC INFORMATION

Aircraft ID number
Operations date
Time of fire
Maximum predicted range (yards) (beam aspect)
Maximum predicted range (yards) (bow aspect)
Maximum predicted range (yards) (aircrew determined)
Layer depth (feet)
Maximum range contact held (yards)
Sea state
Wind speed
Bottom type
Bottom depth

WEAPON INFORMATION

Aircraft ID number
Operations date
Time of fire
Firing sequence number
Launcher station number
Time of attack/reattack
Time zone
Torpedo MK number
Torpedo mod number
Torpedo register number
Torpedo configuration
Torpedo performance
Torpedo acquisition range (yards)
Torpedo run time (seconds)
Torpedo score (hit, miss, invalid)
Weapon failure category
Comment

AIRCRAFT SYSTEM PERFORMANCE SUMMARY

Aircraft ID number
Operations date
Time of fire
GEONAV drift rate (yards/minute)
GEONAV drift direction (degrees)
TACNAV drift rate (yards/minute)

TACNAV drift direction (degrees)
Plot stabilization displacement (yards)
Plot stabilization direction (degrees)
SRS displacement (yards)
SRS direction (degrees)
Number of targets: 1. 2. 3. ...

<u>TRACKING AND ATTACK PERFORMANCE SUMMARY</u>

Aircraft ID number
Operations Date
Time of fire
Number of range vectors
Number of simulated MADS
Number of valid MADS
Number of invalid MADS
Fix error type (yards): 1. 2. 3. ...
Fix error average (for each type)
Fix error standard deviation (for each type)
Course/speed error type (deg/knots): 1. 2. 3. ...
Course/speed average (for each type)
Course/speed standard deviation (for each type)
Buoy type __ active/passive (type 1, 2, 3, ...)
Buoy type __ absolute mean range error (yards)
Buoy type __ absolute mean bearing error (deg)

<u>ERROR TREE #1</u>

Aircraft ID number
Operations date
Time of fire

(errors in yards)

Total miss distance
Total miss distance along
Total miss distance across
Weapon flight
Weapon flight along
Weapon flight across
Target localization
Target localization along
Target localization across
Fix
Fix along
Fix across
Course
Course along
Course across
Speed
Speed along
Speed across

ERROR TREE #2

- Aircraft ID number
- Operations date
- Time of fire
- Aircraft flight
- Aircraft flight along
- Aircraft flight across
- Heading
- Heading along
- Heading across
- Speed and altitude
- Speed and altitude along
- Speed and altitude across
- Drop position
- Drop position along
- Drop position across
- Drop offset
- Drop offset along
- Drop offset across

WEAPON DROP PARAMETERS

- Aircraft ID number
- Operations date
- Time of fire
- Target range actual (yards)
- Target range aircraft
- Target range error
- Target bearing actual (deg)
- Target bearing aircraft
- Target bearing error
- Target course aircraft (deg)
- Target course actual
- Target course error
- Target speed aircraft (knots)
- Target speed actual
- Target speed error
- Target depth aircraft (feet)
- Target depth actual
- Target depth error
- Aircraft course aircraft (deg)
- Aircraft course actual
- Aircraft course error
- Aircraft speed aircraft (knots)
- Aircraft speed actual
- Aircraft speed error
- Aircraft altitude aircraft (feet)
- Aircraft altitude actual
- Aircraft altitude error

<u>WEAPON DROP PARAMETERS CIRCLE MODE</u>

Aircraft ID number
Operations date
Time of fire
Ballistic distance actual (yards)
Ballistic distance aircraft
Ballistic distance predicted
Ballistic time actual (seconds)
Ballistic time aircraft
Ballistic time predicted
Splash point range actual (yards)
Splash point range aircraft
Splash point range predicted
Splash point angle on the bow actual (deg)
Splash point angle on the bow aircraft
Splash point angle on the bow predicted
Splash point latitude actual
Splash point latitude aircraft
Splash point longitude actual
Splash point longitude aircraft
Preset search depth actual (feet)
Preset search depth aircraft
Preset mode actual
Preset mode aircraft

<u>WEAPON DROP PARAMETERS SNAKE MODE</u>

Aircraft ID number
Operations date
Time of fire
Splash point range actual (yards)
Splash point range aircraft
Splash point range ideal
Splash point angle on the bow actual (deg)
Splash point angle on the bow aircraft
Splash point angle on the bow ideal
Splash point lead angle actual (deg)
Splash point lead angle aircraft
Splash point lead angle ideal
Preset search depth actual (feet)
Preset search depth aircraft
Preset search depth ideal
Preset gyro angle actual (deg)
Preset gyro angle aircraft
Preset gyro angle ideal
Probability of hit actual
Probability of hit aircraft

<u>NARRATIVE SECTION</u>

Attack criteria:
Operations summary:

C. SURFACE PACER ANALYSIS DATA SYSTEM DESCRIPTION

ADMINISTRATION	Contents/Description
General Information	Information on participants and exercise
Narrative	Description of exercise events
Ship Information	Ship ID information
ENVIRONMENTAL SECTION	
Acoustic Information	Range, sea state, bottom data
WEAPON SECTION	
Weapon Information	Torpedo ID and performance data
PLATFORM EQUIPMENT CONFIGURATION	
Tube/Launcher Information	System ID and performance data
Fire Control Information	System ID and performance data
Sonar Information	System ID and performance data
TRACKING AND FIRE CONTROL/ATTACK SECTION	
Analysis Summary	Tracking performance information
ASROC Analysis Summary	System orders and setting data
Tube Analysis Summary	System orders and setting data
Drop Information	Aircraft fire control data
PLATFORM AND WEAPON PERFORMANCE	
Error Tree	Fire control system, target evasion, and localization errors

D. SURFACE PACER ANALYSIS DATA SYSTEM DATA DICTIONARY

GENERAL INFORMATION

Ship name
Operations date
Time of fire
Operations type
Exercise location (3D range/location)
PACER Coordinator
Debrief date
Debrief location
Exercise identifier
PACER site
Range event number
Number of firing opportunities
Number of other units involved
SUB:__ VP:__ VS:__ HS:__ HSL:__ SURF:__
Controlling unit
Type of control

Run name/report code
Date entered
Date checked

SHIP INFORMATION

Ship name
Operations date
Time of fire
Ship class
Hull number
Squadron
Homeport

WEAPON INFORMATION

Ship name
Operations date
Time of fire
Firing sequence number
Time zone
Time of attack/reattack
Torpedo MK number
Torpedo mod number
Torpedo register number
Torpedo configuration
Torpedo performance
Torpedo acquisition range (yards)
Torpedo run time (seconds)
Torpedo score (hit, miss, invalid)
Weapon failure category
Comment

ACOUSTIC INFORMATION

Ship name
Operations date
Time of fire
Maximum predicted range (yards) (beam aspect)
Maximum predicted range (yards) (bow aspect)
Maximum predicted range (yards) (ship determined)
Layer depth (feet)
Maximum range contact held (yards)
Sea state
Wind speed
Bottom type
Bottom depth

TUBE/LAUNCHER (TL) INFORMATION

Ship name
Operations date
Time of fire
TL MK number
TL mod number

TL performance
Cause for observed problems
TL MRC
Number of targets: 1. 2. 3. ...
Comments

<u>FIRE CONTROL INFORMATION</u>

Ship name
Operations date
Time of fire
FCS MK
FCS mod
FCS performance
Cause for observed problems
FCS MRC
Comments

<u>SONAR INFORMATION</u>

Ship name
Operations date
Time of fire
Sonar type (could be several per platform)
Mode of operation
Performance
Cause for observed problems
Sonar MRC
Comments

<u>ERROR TREE</u>

Ship name
Operations date
Time of fire
Total attack system (TAS) total error from ideal water entry point
TAS error along
TAS error across
Ballistic/weapon deviation error from ideal
Ballistic/weapon deviation error along
Ballistic/weapon deviation error across
Shipboard systems total error
Shipboard systems error along
Shipboard systems error across
Target evasion/course to steer total error
Target evasion/course to steer error along
Target evasion/course to steer error across
Sonar localization (LOC) total error
LOC error along
LOC error across
Course and speed (CS) determination total error
CS error along
CS error across

Underwater battery (UB) FCS computation error
UBFCS error along
UBFCS error across

<u>ANALYSIS SUMMARY</u>

Ship name
Operations date
Time of fire
Own ships course (CO) ship (deg)
CO range
CO error
Own ships speed (DHMO) ship (knots)
DHMO range
DHMO error
Target course (CT) ship (deg)
CT range
CT error
Target speed (DMHT) ship (knots)
DMHT range
DMHT error
Target range ship (yards)
Target range
Target range error
Target bearing ship (deg)
Target bearing range
Target bearing error
Pattern angle (PA) ship (deg)
PA range
Pattern radius (PR) ship (yards)
PR range
Torpedo gyro angle setting ship (deg)
Torpedo gyro angle setting range
Torpedo gyro angle setting error
Torpedo search depth (SD) ship (feet)
SD range
SD error

<u>ASROC ANALYSIS SUMMARY</u>

Ship name
Operations date
Time of fire
Horizontal range (RHP) ship (yards)
RHP predicted
RHP range
RHP error
Water entry bearing (WEB) ship (deg)
WEB predicted
WEB range
WEB error
Effective range ship (yards)
Effective range predicted

Effective range
Effective range error
Aiming bearing ship (deg)
Aiming bearing predicted
Aiming bearing range
Aiming bearing error
Cutoff velocity (CV) ship
CV predicted
CV range
CV error
Time of separation ship (seconds)
Time of separation predicted
Time of separation range
Time of separation error
Time of flight ship (seconds)
Time of flight predicted
Time of flight range
Time of flight error
Launcher train order ship (deg)
Launcher train order predicted
Launcher train order range
Launcher train order error
Launcher elevation order ship (minutes)
Launcher elevation order predicted
Launcher elevation order range
Launcher elevation order error

<u>TUBE ANALYSIS SUMMARY</u>

Ship name
Operations date
Time of fire
Effective Ra ship
Effective Ra predicted
Effective Ra range
Effective Ra error
Effective Ba ship
Effective Ba predicted
Effective Ba range
Effective Ba error
Aiming Ra ship
Aiming Ra predicted
Aiming Ra range
Aiming Ra error
Aiming Ba ship
Aiming Ba predicted
Aiming Ba range
Aiming Ba error
Course to steer (JCO) ship (deg)
JCO predicted
JCO range
JCO error

<u>DROP INFORMATION</u>

Ship name
Operations date
Time of fire
Target depth at time of fire (feet)
Splash point range from target (yards)
Splash point angle on the bow (deg)
Torpedo base course (deg)
Probability of hit

<u>NARRATIVE SECTION</u>

Attack criteria:
Operations summary:

APPENDIX B

A. SHAREM DATABASE DESCRIPTION

ADMINISTRATIVE SECTION	Contents/Description
Exerid	Dates, area, purpose of exercise
Event	Types and times of events conducted
Abstract	Exercise overview, general notes
Objectives	Intentions for MOE's/overall goals
PARTICIPANTS, SETTINGS, EQUIPMENT	
Pident	Alias coding for SHAREM participants
Partic	Participants in each SHAREM exercise
Particeq	Sonar suites and special equipment
Sonrmode	Sonar operating mode changes
Subaugm	Augmentation frequencies and levels
Subspl	Beartrap data on exercise submarines
Subexpos	Audible/visual submarine events
ENVIRONMENTAL DATA/PREDICTIONS	
Weather	As recorded by participants
Btsvploc	Locations of participant BT drops
Btsvdata	BT data collected during exercise
Actrng	Active range predictions of ships
Passrng	Passive range predictions of ships
ACOUSTIC CONTACTS	
Tims8	Active sonar contacts
Tims24	Passive sonar contacts
Tims30	Sonobuoys deployed, dip data
Tims31	Air attacks, dips, visual, etc
NON-ACOUSTIC CONTACTS	
Tims5	Ship radar and visual contacts
Tims9	ECM and ESM contacts
ATTACKS AND TACTICS	
Srfcm	Ship countermeasures employed
Subcm	Submarine countermeasures employed
Wpncmdet	Weapon countermeasures detected
Tims11	Ship attacks
COURSE, SPEED, DEPTH DATA	
Tracks	Participant movements
Intertgt	Ranges and bearings between units
COMMAND AND CONTROL	
Iusscue	IUSS cuing evaluations

B. SHAREM DATABASE DATA DICTIONARY

EXERID

Exid - exercise number
Exname - exercise name
Exspan - inclusive date span
Exmo - month of exercise
Exyr - year of exercise
Exzn - local time zone of exercise
Extype - type of exercise
Exloc - abbreviated ocean area
Exlatlong - exercise lat/long
Sw - shallow water exercise (y)
Iw - intermediate water exercise (y)
Dw - deep water exercise (y)

EVENT

Exid
Event - event number
Evtype - type of event
Tz - time zone (zulu time is always used
Comex - event start
Finex - event stop

ABSTRACT

Exid
Textseq - sequential numbers for indexing text lines
Abstract - brief narrative of exercise

OBJECTIVES

Exid
Textseq
Objective - text of objective

PIDENT

Pid - alphanumeric code assigned to each participant
Htype - hull type of ships
Hnum - hull number for ships
Ptype - type of participant
Clid - ship class leader
Cntry - standard two letter country codes
Pname - name of participant

PARTIC

Exid
Event
Pid
Id - hull, side, reg, or flight number
Occn - occurrence number: to denote repetitive appearances of same pid in an event/exercise
Pru - prairie/masker status (y/n)

Numprop - number of propellers participant has
Numblds - number of blades/propeller
Shftrpm - turns per knot ratio for 10 knots

<u>PARTICEQ</u>

Exid
Pid
Eqtype - equipment type
Eqid - equipment MK-mod designation, A/N designation, or noun name
Rmk - clarify equipment usage/application

<u>SONRMODE</u>

Exid
Event
Pid
Jtim - log entry time of change
Sonr - sonar type
Status - sonar status
Pbbstat - dimus/other status
Amode - sonar mode
Secntr - sector center (deg)
Secwidth - sector width (deg)
Scale - range scale/zone width (kyards)
Zstart - zone start (kyards)
Freq - frequency setting
Atten - transmit power attenuation (dB)
Depress - depression angle
Sendpth - depth of array/VDS (feet)
Odtpulse - ODT pulse length (msec)

<u>SUBAUGM</u>

Exid
Event
Pid
Jtim - time
Status - status of noise augmenter
Freq1 - frequency 1
Sl1 - source level 1
Freq2
Sl2
Freq3
Sl3
Freq4
Sl4
Lfbbl - low frequency broadband augmentation, low end
Lfbbh - low frequency broadband augmentation, high end
Lfbbsl - low frequency broadband source level
Hfbbl - high frequency broadband augmentation, low end
Hfbbu - high frequency broadband augmentation, high end

Hfbbsl - high frequency broadband source level
Remarks - to support missing data fields/analytical comment

SUBSPL

Exid
Event
Pid
Jtim
Srce - source of radiated noise
Dpth - depth of submarine (feet)
Spd - speed of submarine (knots)
Freq - frequency
Bbul - broadband upper limit
Rspl - request spl
Spl000 - sound pressure level @ 000° relative bearing (dB)
Spl010 - sound pressure level @ 010° relative bearing
. .
. .
. .
Spl350 - sound pressure level @ 350° relative bearing

SUBEXPOS

Exid
Event
Pid
Jtim
Opmode - operation mode
Exposed - submarine exposed code
Eqtype - equipment operating
Eqstat - equipment status
Subrmk - remarks

WEATHER

Exid
Event
Pid
Jtim
Sky_ceil - sky and ceiling (100's feet)
Vis - (nm)
Visobs - weather and obstructions to visibility
Airtemp - air temperature (1/10 deg F)
Dewpoint - dewpoint temperature (deg F)
W_dir - wind direction (deg)
W_spd - wind speed (knots)
Weaxrmk - narrative
Skycvr - amount of overcast (1-10)
Seatemp - Seawater injection temperature (1/10 deg F)
Pwave - wave period (sec)
Hwave - wave height (feet)
Dswell - swell wave direction (deg)

Pswell - swell wave period (sec)
Hswell - swell wave height (feet)

<u>BTSVPLOC</u>

Exid
Event
Pid
Jtim
Latd - latitude degrees
Latm - latitude minutes
Latf - latitude N/S
Lond - longitude degrees
Lonm - longitude minutes
Lonf - longitude E/W
Lat - latitude
Lon - longitude

<u>BTSVPDATA</u>

Exid
Pid
Jtim
Dpth - depth (feet)
Dtype - entry key for data type: V:velocity
T:temperature
Data - numeric data per dtype (fps/°F)

<u>ACTRNG</u>

Exid
Event
Pid
Jtim
Sonr
Sld - sonic layer depth (feet)
Wspd - wind speed (knots)
Botdpth - bottom depth (feet)
Mgs - bottom loss province
System - prediction system used
Release - software release
Spd - ship speed (knots)
Nl - noise level (dB)
Ts - target strength (dB)
Sendpth - sensor depth (feet)
Sonrm - sonar mode
Pdr - Periscope depth range (kyards)
Bdr - best depth range
Cz - detection to n^{th} convergence zone (kyards)
Cz1start - first CZ start (kyards)
Cz1stop - first CZ stop (kyards)
Pdbbstart - periscope depth bottom bounce start (kyards)
Pdbbstop - periscope depth bottom bounce stop (kyards)

Bdbbstart - best depth bottom bounce start (kyards)
Bdbbstop - best depth bottom bounce stop (kyards)
remarks

<u>PASSRNG</u>

Exid
Event
Pid
Jtim - Bt drop time
Sonr
Eval - prediction evaluation
Sld - sonic layer depth (feet)
Wspd - wind speed (knots)
Botdpth - bottom depth (feet)
Mgs - bottom loss province
System - prediction system used
Release - software release
Spd - ship speed (knots)
Freq - frequency used in calculation
Sl - source level
Le - noise level
Rd - recognition differential
Fom - figure of merit
Sendpth - sensor depth (feet)
Tgtdpth - target depth (feet)
Dpr - direct path range (kyards)
Cz - detection to n^{th} convergence zone (kyards)
Czlstart - first CZ start (kyards)
Czlstop - first CZ stop (kyards)

<u>TIMS8</u>

Exid
Event
Pid
Contnum - contact number
Jtim
Brg - true bearing to contact (deg)
Rng - range to contact (nm)
Sensor - 'active' sensor
S - contact status
Cty - classification
Sm - event type
Ls - contact validity

<u>TIMS24</u>

Exid
Event
Pid
Contnum - contact number
Jtim

Brg - true bearing to contact (deg)
Sensor - 'passive' sensor
S - contact status
Depth - towed array cable scope
Ac - ambiguity code
Freq_a - frequency a
Freq_b
Freq_c
Ct - classification type
Sm - event type
T_cse - ambiguous bearing (deg)
T_br - target signal to noise ratio (dB)
Ls - contact validity

<u>TIMS30</u>

Exid
Event
Pid
Jtim
Buoyid - buoy type/channel/dip number
Latitude - drop point lat
Longitude - drop point long
Depth - depth of buoy or dipping sonar (feet)
Life - sonobuoy life (hours)/dip duration (min)
Stores - aircraft two letter code who deployed buoy or marked dip
Bb - bad buoy flag
Su - event type

<u>TIMS31</u>

Exid
Event
Pid
Jtim
Buoyid - buoy type/dip number/air attack no./air non-acoustic contacts
Latitude
Longitude
Brg - bearing
Rng - range
Son_ty - aircraft two letter code and side number
Target - contact validity
Eval - attack evaluation
Contnum - contact no. for sonobuoys or attack criteria code
Freq - sonobuoy contact frequency
Dopchg - attacking vehicle and type of attack
Band - attack evaluation
Cat - classification
Su - event type
Rbrg - bearing from parent ship to aircraft

Rrng - range from parent ship to aircraft

<u>TIMS5</u>

Exid
Event
Pid
Contum
Jtim
Brg - bearing to contact
Rng - range to contact
Sensor - non-acoustic sensor
St - contact status
Cl - contact classification
Sm - event type
Ls - contact validity

<u>TIMS9</u>

Exid
Event
Pid
Contnum
Jtim
Brg - bearing to contact
Rng - range to contact
Sensor
Stat - contact status
Cls - event type
Freq - contact frequency
Emi_ty - contact validity

<u>SRFCM</u>

Exid
Event
Pid
Jtim
Cmdact - countermeasure deactivation time
Cmtyp - CM type
Cmopmd - operation mode
Cycle - cycle timer (y,n)
Tmoff - cycle timer off (sec)
Tmon - cycle timer on (sec)
Filter - identifies which filter on
Towscop - tow cable scope (feet)
Cmrmk - remarks

<u>SUBCM</u>

Exid
Event
Pid
Jtim
Cmtyp - CM type

Cmopmd - operation mode
Hdth - hover depth
Dlay - delay time (min)
Tube - port or starboard tube number
Own - own ship course
Dettm - detection time
Cmrmk - remarks

WPNCMDET
Exid
Event
Pid
Jtim
Cntnum
Clas - detection classification
Dbrg - detection bearing
Drng - detection range (yards)
Clastm - classification time
Mthd - detection method
Cmtyp - countermeasure type
Wcmrmk - remarks

TIMS11
Exid
Event
Pid
Jtim
Cntnum
Brg - bearing to contact
Rng - range to contact
Fcsnum - fire control system number
Sm - event type
Hm - hit/miss code
Rm - contact validity
At - attack criteria
Ta - type of attack

TRACKS
Exid
Event
Pid
Jtim
Occn - occurrence number
Latd - latitude degrees
Latm - latitude minutes
Latf - latitude flag (N/S)
Lond - longitude degrees
Lonm - longitude minutes
Lonf - longitude flag (E/W)
Lat - latitude
Lon - Longitude

Crs - course (deg)
Spd - speed (knots)
Dpth - depth (feet)
Head - heading (deg)

<u>INTERTGT</u>

Exid
Event
Pid
Jtim
Etim - event time seconds from start of year
Tpid - ID code for target
Rng - range to target (yards)
Tbrg - true bearing to target
Brg - relative bearing to target
Asp - aspect angle
Code - codes for key track events

<u>IUSSCUE</u>

Exid
Event
Msgdtg - DTG of SOSUS RED/RED AMP or voice report
Commpath - message transmittal code
Desig - COSP/COSL designator from message
Msgqual - message qualifier from MSGID line
Qualnr - serial number of qualifier from MSGID line
Pid
Msgtor - time of receipt of message or voice report
Type - SPA type
Latd - latitude degrees
Latm - latitude minutes
Latf - latitude flag (N/S)
Lond - longitude degrees
Lonm - longitude minutes
Lonf - longitude flag (E/W)
Lat - latitude
Lon - Longitude
Brg - bearing of semi-major axis of ellipse
Length - length of semi-major axis
Width - length of semi-minor axis
Sqnm - area of SPA
Tevnt - event time from message
Evnt - event from message
Sensor - sensor/source
Sensorpid - pid of SURTASS ship holding contact
Tpid - target identification code
Inspa - containment, in or out of SPA
Tclas - time between tevnt and msgdtg (min)*
Tcomm - communications delay; time between msgdtg and msgtor (min)*
Tlate - time late of cuing info equal to sum of tclas

and tcomm (min)*
* Derived field

APPENDIX C

A. AIREM DATABASE DESCRIPTION

ADMINISTRATION SECTION	Contents/Description
Exercise	Exercise and participant descriptions
Expendables	Expendables use and failure
Event Time	Times of discrete ASW mission events
Deficiencies	Narrative of exercise deficiencies
PLATFORM EQUIPMENT CONFIGURATION SECTION	
Aircraft Fitment	Types of airborne equipment
Crew and Equipment	Airborne equipment operational status and assessment of aircrew proficiency
ENVIRONMENTAL SECTION	
Environmental	Environmental exercise conditions
Acoustic Prediction	Predicted detection ranges for sensors
Ambient Noise	Measured ambient noise
CONTACT INFORMATION SECTION	
Target Profile	Acoustic characteristics of target
Detection	Target detection and classification data for each sensor
Classification Summary	Classification success data, including classification of false targets
Bearing and Range Error	Aggregate data for sensor bearing and range errors observed during exercise
ATTACK AND TACTICS SECTION	
Localization	Data on localization tactic and sensor used, and success of localization attempt
Fix and Track Accuracy	Fix and track errors for sensors used, with sample sizes of statistics
Tracking Performance	Target tracking performance as percentage of contact hold time
Attack Performance	Aircraft, target, and weapon splash data for actual weapon drops

B. AIREM DATABASE DATA DICTIONARY

EXERCISE TABLE

Ex_nbr - AIREM exercise number
Ex_loc - location of exercise
Ex_start - exercise start date
Ex_end - exercise end date
OSE - officer scheduling exercise
OCE - officer conducting exercise

Air_part - exercise participants, aircraft squadrons
Surf_part - exercise participants, surface
Sub_part - exercise participants, submarine
Pri_obj - primary exercise objectives
Sec_obj - secondary exercise objectives

AIRCRAFT FITMENT TABLE

Ex_nbr
Sqd_nbr - aircraft squadron number
Side_nbr - aircraft side number
Acft_mod - aircraft model designation
Processor - acoustic processor
Ins - inertial navigation system
Tacnav - tactical navigation system
Radar - search radar system
MAD - MAD detection system
ESM - ESM system
IR - IR sensor system
Dipper - dipping sonar system
PTA - passive tracking software (y/n)

TARGET PROFILE TABLE

Ex_nbr
Tgt_ind - target index
Tgt_type - type of target
Sail_nbr - sail number of mobile target designation
Augmnt - augmented submarine (y/n)
Freq1 - radiated frequency number one (hz)
Level1 - source level frequency number one (dB)
Methd1 - method of determining SL of frequency one
Freq2 - radiated frequency number two (hz)
Level2 - source level frequency number two (dB)
Methd2 - method of determining SL of frequency two
Freq3 - radiated frequency number three (hz)
Level3 - source level frequency number three (dB)
Methd3 - method of determining SL of frequency three
Freq14- radiated frequency number four (hz)
Level4 - source level frequency number four (dB)
Methd4 - method of determining SL of frequency four
Freq5 - radiated frequency number five (hz)
Level5 - source level frequency number five (dB)
Methd5 - method of determining SL of frequency five
Coat - coated target (y,n)
Tgt_strg - target strength (dB)
Tgt_class - classification of target

ENVIRONMENTAL TABLE

Ex_nbr
Env_ind - environmental index
Sea_st - sea state
Cloud - cloud cover in tenths

Precip - amount of precipitation
Ceiling - ceiling height (feet)
Wind_dir - wind direction (deg)
Wind_spd - wind speed (knots)
Mag_var - magnetic variation (1/10 deg)
Mag_noise - magnetic noise (kilo index)
Rad-duct - radar duct present (y,n)
Duct_alt - radar duct altitude (feet)
Duct_hgt - radar duct height (feet)
Ambient - ambient noise level
Shp_dens - shipping density

ACOUSTIC PREDICTION TABLE
Ex_nbr
App_ind - acoustic range prediction index
Sensor - sensor designation
Ap_sys - acoustic prediction system
Tgt_dpth - target depth (feet)
Sen_dpth - sensor depth (feet)
Freq - frequency (hz)
Pl_class - propagation loss classification
Pred_rng - predicted range (kyards)

AMBIENT NOISE TABLE
Ex_nbr
An_ind - ambient noise measurement index
Freq - measured frequency (hz)
Dpth - depth of measurement
An_db - measured ambient noise (dB)

CREW AND EQUIPMENT TABLE
Ex_nbr
Evt_desg - event designator
Sortie - sortie number
Sqd_nbr - squadron number
Acft_nbr - aircraft side number
Crew - crew proficiency
Processor - acoustic processor
INS - INS status
TACNAV - TACNAV status
Radar - radar status
MAD - MAD status
ESM - ESM status
IR - IR status
Dipper - dipping sonar status
Link - data link system status
GPDC - general purpose digital computer status

DETECTION TABLE
Ex_nbr
Evt_desg - event designator

Sortie - sortie number
Sqd_nbr - squadron number
Acft_nbr - aircraft side number
Sensor
Crw_alrt - crew alertment level
Sens_dpth - sensor depth or altitude (feet)
Tgt_dpth - target depth or exposure
Tgt_spd - target speed (knots)
CPA_rng - CPA range (yards)
Det_opp - detection opportunity (y,n)
Rng_opp - target range at time of opportunity (yards)
Fre_opp - signal frequency at detection opportunity (hz)
Pl_opp - propagation loss at time of detection opportunity
Det_nd - detection or no detection sample
Det_rng - detection range (yards)
Det_time - time of detection
Det_fre - signal frequency at time of detection
Det_pl - one-way prop loss at time of detection
Clas_flg - was classification attempt made (y,n)
Clas_tme - time valid classification was made
Clas_rng - target range at time of valid classification
Lc_time - time contact lost
Lc_rng - range at time of lost contact
Tgt_ind - target index
Env_ind - environmental index
App_ind - acoustic range prediction index
An_ind - ambient noise measurement index

CLASSIFICATION SUMMARY TABLE

Ex_nbr
Evt_desg - event designator
Sortie - sortie number
Sqd_nbr - squadron number
Acft_nbr - aircraft side number
Sensor
Tot_sub - total number of target classified subsurface
Val_sub - number of valid submarine classifications
Nval_sub - number of non-valid submarine classifications
Tot_nsub - total number of targets classified non-sub
Val_nsub - number of correct non-sub classifications
Nval_nsub - number of incorrect non-sub classifications
Srch_hrs - search time for this sensor
Nbr_fc - number of false contacts
Nbr_recl - number of non-valid classifications downgraded
Avgt_recl - average time to downgrade false contacts
Nbr_att - number of false contacts attacked
Avgt_pros - average time spent prosecuting false contacts
App_ind - acoustic range prediction index

EXPENDABLES TABLE

Ex_nbr
Evt_desg - event designator
Sortie - sortie number
Sqd_nbr - squadron number
Acft_nbr - aircraft side number
Exp_desc - description of expendable
Exp_type - type of expendable
Nbr_exp - number of expendables used
Nbr_fail - number of expendables that failed

LOCALIZATION TABLE

Ex_nbr
Evt_desg - event designator
Sortie - sortie number
Sqd_nbr - squadron number
Acft_nbr - aircraft side number
Val_fal - localization attempt of valid or false contact
Tac_sens - localization tactics and sensor used
Final_sens - final sensor used in localization
Localize - successful localization within 1000 yards (y,n)
Elp_time - elapsed time from classification to localization or end of a localization attempt (min)
Eltm_det - elapsed time from detection to localization or end of a localization attempt (min)
Rge_det - target range at time of detection
Tgt_ind - target index
Env_ind - environmental index
App_ind - acoustic range prediction index
An_ind - ambient noise measurement index

FIX AND TRACK ACCURACY TABLE

Ex_nbr
Acft_mod
Sensor
Fix_min - mean of fix errors (yards)
Fix_sd - standard deviation of fix error (yards)
Fx_sampl - sample size for fix error
Cus_mn - mean of course error (deg)
Cus_sd - standard deviation of course error (deg)
Sspd_mn - mean of signed speed errors (knots)
Sspd_sd - standard deviation of signed speed errors (knots)
Uspd_mn - mean of unsigned speed errors (knots)
Uspd_sd - standard deviation of unsigned speed errors (knots)
Rms - root mean square of speed errors (knots)
Trk_smpl - sample size of track estimate error
Tgt_ind - target index

Env_ind - environmental index
An_ind - ambient noise measurement index

TRACKING PERFORMANCE TABLE

Ex_nbr
Evt_desg - event designator
Sortie - sortie number
Sqd_nbr - squadron number
Acft_nbr - aircraft side number
Sensor
Trk_period - total tracking period (min)
Pct_held - time percentage target held during tracking period
Max_hold - maximum uninterrupted hold time (min)
Tgt_ind - target index
Env_ind - environmental index
App_ind - acoustic range prediction index
An_ind - ambient noise measurement index

EVENT TIME TABLE

Ex_nbr
Evt_desg - event designator
Sortie - sortie number
Sqd_nbr - squadron number
Acft_nbr - aircraft side number
Rg_onsta - range to on-station (nm)
To_onsta - time from take-off to on-station (min)
Ost_det - time from on-station to first detection (min)
Det_lcl - time from first detection to localization within 1000 yards (min)
Lcl_atk - time from localization to first attack (min)
On_ofsta - time from on-station to off-station (min)
To_ldg - time from take-off to landing
Trg_sens - trigger sensor for first detection

DEFICIENCIES TABLE

Ex_nbr
Def1 - deficiency number 1
Def2 - deficiency number 2
Def3 - deficiency number 3
Def4 - deficiency number 4
Def5 - deficiency number 5
Def6 - deficiency number 6
Def7 - deficiency number 7
Def8 - deficiency number 8

ATTACK PERFORMANCE TABLE

Ex_nbr
Evt_desg - event designator
Sortie - sortie number
Sqd_nbr - squadron number

Acft_nbr - aircraft side number
Sub_fc - valid or false contact

Delt_cls - elapsed time between target classification and start of attack (min)
Delt_det - elapsed time between target detection and start of attack (min)
Rng_det - target range at detection
Rttk_flg - is this a reattack (y,n)
Atk_crit - attack criteria used for weapon drop
Sensor - primary attack sensor
Wpn_typ - weapon type
Aim_ptb - bearing of aim point relative to target course
Aim_ptr - range of aim point from target (yards)
Srch_ty - torpedo attack, snake or circle search
Srch_dp - torpedo attack, initial search depth (feet)
Tgt_cus - target course at time of fire (TOF)
Tgt_spd - target speed at TOF (knots)
Tgt_dpt - target depth at TOF
Tgt_cm - countermeasures deployed by target
Ac_hdng - aircraft true heading at TOF
Ac_spd - aircraft speed at TOF
Ac_alt - aircraft altitude at TOF (feet)
Splbrg - bearing of splash point relative to target course
Spl_rng - range of splash point from target
Torp_hit - actual torpedo run to turnaway (y,n)
Tgt_ind - target index
Env_ind - environmental index
An_ind - ambient noise measurement index

<u>BEARING AND RANGE ERROR TABLE</u>

Ex_nbr
Acft_mod
Sensor
Mn_sberr - mean of signed bearing error
Sd_sberr - standard deviation of signed bearing error
Mn_uberr - mean of unsigned bearing error
Sd_uberr - standard deviation of unsigned bearing error
Rms_berr - RMS value of the bearing error
Brg_sampl - sample size for the bearing error
Mn_srerr - mean of signed range error
Sd_srerr - standard deviation of signed range error
Mn_urerr - mean of unsigned range error
Sd_urerr - standard deviation of unsigned range error
Rms_rerr - RMS value of the range error
Mn_rtgt - mean range of the target (kyards)
Sd-rtgt - standard deviation of the range to the target
Rng_sampl - sample size for the range error
Tgt_ind - target index
Env_ind - environmental index
An_ind - ambient noise measurement index

APPENDIX D

A. SYNONYM ATTRIBUTE TABLE

The following table provides a listing of all the synonym attributes across the four databases. In some cases there is more than one attribute listed as a synonym for another, and in these cases the single attribute encompasses an area covered by multiple attributes in another database.

ADMINISTRATION

AIR PACER	SURFACE PACER	AIREM	SHAREM
AIRCRAFT ID#	SHIP NAME	SQD_NBR SIDE_NBR SORTIE	PID
OPERATION DATE		EX_START	EXSPAN
TIME OF FIRE		TO_ONSTA OST_DET DET_LCL ON_OFSTA TO_LOG	JTIM
OPERATION TYPE		--	EXTYPE
EXERCISE LOCATION		EX_LOC	EXLOC EXLATLONG
EXERCISE ID		EX_NBR	EXID
RANGE EVENT NBR		EVT_DESG	EVENT
OTHER PARTICIPANTS		AIR_PART SURF_PART SUB_PART	PID
----	----	PRI_OBJ SEC_OBJ	OBJECTIVE
----	SHIP CLASS	ACFT_MOD	HTYPE
----	HULL NUMBER	SIDE_NBR	--
----	SQUADRON	SQD_NBR	--
TIME ZONE		--	EXZN

PLATFORM EQUIPMENT CONFIGURATION

AIR PACER	SURFACE PACER	AIREM	SHAREM
	TL MK NUMBER	PROCESSOR	EQTYPE EQID
	TL MOD NUMBER	INS	FCSNUM
	FCS MK	TPCNAN	
	FCS MOD	RADAR	
		MAD	
		ESM	
		IR	
		DIPPER	
		PTA	

AIR PACER	SFC PACER	AIREM	SHAREM
BUOY TYPE	SONAR TYPE	SENSOR	SONR
			BUOYID
----	MODE OF OPERATION	--	SONRMODE*

* synonym of entire table

ENVIRONMENTAL DATA			
MAXIMUM PREDICTED RANGE		PRED_RNG	PDR
			BDR
			CZ
			CZLSTART
			CZLSTOP
			BDBBSTART
			BDBBSTOP
			PDBBSTART
			PDBBSTOP
			DPR
LAYER DEPTH		--	SLD
SEA STATE		SEA_ST	--
WIND SPEED		WIND_SPD	W_SPD
BOTTOM DEPTH		--	BOTDPTH
----	----	WIND_DIR	W-DIR
		CLOUD	SKYCUR
		CEILING	SKY_CEIL
CONTACT INFORMATION			
TARGET RANGE		RNG_DET	RNG
TARGET BEARING		--	BRG
TARGET COURSE		TGT_CUS	HEADING
TARGET DEPTH		TGT_DPTH	DPTH
TARGET SPEED		TGT_SPD	SPD
ATTACK AND TACTICS INFORMATION			
ACFT CSE	OWN SHIP CSE	AC_HONG	CRS
ACFT SPEED	OWN SHIP SPD	AC_SPD	SPD
ACFT ALTITUDE	----	AC_ALT	--
SPLASH POINT ANGLE ON BOW		SPL_BRG	
SPLASH POINT RANGE		SPL_RNG	
PRESET SRCH DPTH	TORP SRCH DPTH	SRCH_BP	
TORPEDO REGISTER NUMBER			ID
		TORP_HIT	HM

2. AIREM and SHAREM

AIREM	SHAREM
AUGMENT	STATUS
FREQ1,FREQZ...	FREQ1,FREQZ...
LEVEL1,LEVEL2...	SL1,SL2...
AP_SYS	SYSTEM
TGT_STRG	TS
TGT_DPTH	DPTH,TGTDPTH
SEN_DPTH	SENDPTH

AIREM	SHAREM
FREQ	FREQ
TGT_CM	CMTYP

B. ANTONYM ATTRIBUTE TABLE

PACER COORDINATOR
DEBRIEF DATE
DEBRIEF LOCATION
PACER SITE
UNIT ID/SIDE NUMBER
CREW NUMBER
WING
HOME BASE/SHIP
CONTROLLING UNIT
TYPE OF CONTROL
RUN NAME/REPORT CODE
DATE ENTERED
DATE CHECKED
BOTTOM TYPE
FIRING SEQUENCE NUMBER
LAUNCHER STATION NUMBER
TIME OF ATTACK/REATTACK
TORPEDO MK NUMBER
TORPEDO MOD NUMBER
TORPEDO CONFIGURATION
TORPEDO PERFORMANCE
TORPEDO ACQUISITION RANGE
WEAPON FAILURE CATEGORY
COMMENT
GEONAV DRIFT RATE
GEONAV DRIFT DIRECTION
TACNAV DRIFT RATE
TACNAV DRIFT DIRECTION
PLOT STABILIZATION DISPLACEMENT
PLOT STABILIZATION DIRECTION
SRS DISPLACEMENT
SRS DIRECTION
NUMBER OF TARGETS
NUMBER OF RANGE VECTORS
NUMBER OF SIMULATED MADS
NUMBER OF VALID MADS
NUMBER OF INVALID MADS
PRESET GYRO ANGLE AIRCRAFT
BALLISTIC DISTANCE AIRCRAFT
BALLISTIC TIME AIRCRAFT
SPLASH POINT LATITUDE
SPLASH POINT LONGITUDE
PRESET SEARCH DEPTH AIRCRAFT
PRESET MODE AIRCRAFT
SPLASH POINT LEAD ANGLE AIRCRAFT

2. Surface PACER Database

PACER COORDINATOR
DEBRIEF DATE
DEBRIEF LOCATION
PACER SITE
CONTROLLING UNIT
TYPE OF CONTROL
RUN NAME/REPORT CODE
DATE ENTERED
DATE CHECKED
HOMEPORT
FIRING SEQUENCE NUMBER
TIME OF ATTACK/REATTACK
TORPEDO MK NUMBER
TORPEDO MOD NUMBER
TORPEDO CONFIGURATION
TORPEDO PERFORMANCE
TORPEDO ACQUISITION RANGE
TORPEDO RUN TIME
WEAPON FAILURE CATEGORY
BOTTM TYPE
TL PERFORMANCE
CAUSE FOR OBSERVED PROBLEMS
TL MRC
NUMBER OF TARGETS
FCS PERFORMANCE
CAUSE FOR OBSERVED
FCS MRC
COMMENTS
PERFORMANCE
CAUSE FOR OBSERVED PROBLEMS
SONAR MRC
CO RANGE
DHMO RANGE
CT RANGE
DMHT RANGE
TARGET RANGE
TARGET BEARING RANGE
PA RANGE
PATTERN RADIUS SHIP
PR RANGE
TORPEDO GYRO ANGLE SETTING SHIP
TORPEDO GYRO ANGLE SETTING RANGE
TORPEDO SEARCH DEPTH SHIP
SD RANGE
HORIZONTAL RANGE SHIP
RHP PREDICTED
RHP RANGE
WATER ENTRY BEARING SHIP
WEB PREDICTED
WEB RANGE

EFFECTIVE RANGE SHIP
EFFECTIVE RANGE PREDICTED
EFFECTIVE RANGE
AIMING BEARING SHIP
AIMING BEARING PREDICTED
AIMING BEARING RANGE
CUTOFF VELOCITY SHIP
CV PREDICTED
CV RANGE
TIME OF SEPARATION SHIP
TIME OF SEPARATION PREDICTED
TIME OF SEPARATION RANGE
TIME OF FLIGHT SHIP
TIME OF FLIGHT PREDICTED
TIME OF FLIGHT RANGE
LAUNCHER TRAIN ORDER SHIP
LAUNCHER TRAIN ORDER PREDICTED
LAUNCHER TRAIN ORDER RANGE
LAUNCHER ELEVATION ORDER SHIP
LAUNCHER ELEVATION ORDER PREDICTED
LAUNCHER ELEVATION ORDER RANGE
EFFECTIVE RA SHIP
EFFECTIVE RA PREDICTED
EFFECTIVE RA RANGE
EFFECTIVE BA SHIP
EFFECTIVE BA PREDICTED
EFFECTIVE BA RANGE
AIMING RA SHIP
AIMING RA PREDICTED
AIMING RA RANGE
AIMING BA SHIP
AIMING BA PREDICTED
AIMING BA RANGE
COURSE TO STEER SHIP
JCO PREDICTED
JCO RANGE
TORPEDO SHAREMODE
3. SHARE Database
SW
IW
DW
EVTYPE
TZ
COMEX
FINEX
ABSTRACT
PTYPE
CLID
CNTRY
PNAME
OCCN

PRU
NUMPROP
NUMBLDS
SHFTRPM
STATUS
PBBSTAT
LFBBL
LFBBH
LFBBSL
HFBBL
HFBBU
HFBBSL
SRCE
SPD
BBUL
RSPL
SPL000
SPL010
OPMODE
EXPOSED
EQTYPE
EQSTAT
SUBRMK
VIS
VISOBS
AIRTEMP
DEWPOINT WEAXRMK
SEATEMP
PWAVE
HWAVE
DSWELL
PSWELL
HSWELL
LATD
LATM
LATF
LOND
LONM
LONF
LAT
LON
DTYPE
DATA
MGS
RELEASE
SPD
N1
SONRM
EVAL
SL
LE

RD
ROM
CONTNUM
S
CTY
SM
LS
DEPTH
AC
FREQ_A
FREQ_B
FREQ_C
CT
T_CSE
T_BR
LATITUDE
LONGITUDE
LIFE
STORES
BD
SU
SON_TY
TARGET
EVAL
DOPCHG
BAND
CAT
RBRG
RRNG
ST
CL
STAT
CLS
EMI_TY
CMDACT
CMOPMD
CYCLE
TMOFF
TMON
FILTER
TOWSCOP
CMRMK
HDTH
DLAY
TUBE
OWN
DETTM
CNTNUM
CLAS
DBRG
DRNG

CLASTM
MTHD
WCMRMK
RM
AT
TA
ETIM
TPID
TBRG
ASP
CODE
MSGDTG
COMMPATH
DESIG
MSGQUAL
QUALNR
MSGTOR
TYPE
BRG
LENGTH
WIDTH
SQNM
TEVNT
EVNT
SENSORPID
INSPA
TCLAS
TCOMM
TLATI. **AIREM Database**
OSE
OCE
TGT_IND
TGT_TYPE
SAIL_NBR
METHD1
METHD2
METHD3
METHD4
METHD5
TGT_CLASS
ENV_IND
PRECIP
MAG_VAR
MAG_NOISE
RAD_DUCT
DUCT_ALT
DUCT_HGT
AMBIENT
SHP_DENS
APP_IND

PL_CLASS
AN_IND
AN_DB
CREWS
INS
TACNAV
RADAR
MAD
ESM
IR
DIPPER
LINK
GPDC
CRW_ALRT
CPA_RNG
DET_ND
DET_TIME
DET_FRE
DET_PL
CLAS_FLG
CLAS_TIME
CLAS_RNG
LC_TIME
LC_RNG
EXP_DESC
EXP_TYPE
TAC_SENS
FINAL_SENS
DEF1
DEF2
DEF3
DEF4
DEF5
DEF6
DEF7
DEF8
SUB_FC
DELT_CLS
DELT_DET
RTTK_FLG
ATK_CRIT
WPN_TYP
AIM_PTB
AIM_PTR
SRCH_TY

C. ADDITIONAL ANTONYM ATTRIBUTES

The following attributes can be determined through data analysis with the integrated database and are therefore listed separately in this table.

1. Air PACER Database

NUMBER OF FIRING OPPORTUNITIES
MAXIMUM RANGE CONTACT HELD
TORPEDO RUN TIME
FIX ERROR TYPE
FIX ERROR AVERAGE
FIX ERROR STANDARD DEVIATION
COURSE/SPEED ERROR TYPE
COURSE/SPEED AVERAGE
COURSE/SPEED STANDARD DEVIATION
BUOY TYPE
TOTAL MISS DISTANCE
TOTAL MISS DISTANCE ALONG
TOTAL MISS DISTANCE ACROSS
WEAPON FLIGHT
WEAPON FLIGHT ALONG
WEAPON FLIGHT ACROSS
TARGET LOCALIZATION
TARGET LOCALIZATION ALONG
TARGET LOCALIZATION ACROSS
FIX
FIX ALONG
FIX ACROSS
COURSE
COURSE ALONG
COURSE ACROSS
SPEED
SPEED ALONG
SPEED ACROSS
AIRCRAFT FLIGHT
AIRCRAFT FLIGHT ALONG
AIRCRAFT FLIGHT ACROSS
HEADING
HEADING ALONG
HEADING ACROSS
SPEED AND ALTITUDE
SPEED AND ALTITUDE ALONG
SPEED AND ALTITUDE ACROSS
DROP POSITION
DROP POSITION ALONG
DROP POSITION ACROSS
DROP OFFSET
DROP OFFSET ALONG
DROP OFFSET ACROSS
TARGET RANGE ACTUAL
TARGET RANGE ERROR
TARGET BEARING ACTUAL
TARGET BEARING ERROR
TARGET COURSE ACTUAL
TARGET COURSE ERROR
TARGET SPEED ACTUAL

TARGET SPEED ERROR
TARGET DEPTH ACTUAL
TARGET DEPTH ERROR
AIRCRAFT COURSE ACTUAL
AIRCRAFT COURSE ERROR
AIRCRAFT SPEED ACTUAL
AIRCRAFT SPEED ERROR
AIRCRAFT ALTITUDE ACTUAL
AIRCRAFT ALTITUDE ERROR
BALLISTIC DISTANCE ACTUAL
BALLISTIC DISTANCE PREDICTED
BALLISTIC TIME ACTUAL
BALLISTIC TIME PREDICTED
SPLASH POINT RANGE ACTUAL
SPLASH POINT RANGE PREDICTED
SPLASH POINT ANGLE ON THE BOW ACTUAL
SPLASH POINT ANGLE ON THE BOW PREDICTED
SPLASH POINT LATITUDE ACTUAL
SPLASH POINT LONGITUDE ACTUAL
PRESET SEARCH DEPTH ACTUAL
PRESET MODE ACTUAL
SPLASH POINT RANGE IDEAL
SPLASH POINT LEAD ANGLE ACTUAL
SPLASH POINT LEAD ANGLE IDEAL
PRESET SEARCH DEPTH IDEAL
PRESET GYRO ANGLE ACTUAL
PRESET GYRO ANGLE IDEAL
PROBABILITY OF HIT ACTUAL
PROBABILITY OF HIT AIRCRAFT

2. Surface PACER Database

NUMBER OF FIRING OPPORTUNITIES
TARGET DEPTH ACTUAL
TARGET DEPTH ERROR
AIRCRAFT COURSE ACTUAL
AIRCRAFT COURSE ERROR
AIRCRAFT SPEED ACTUAL
AIRCRAFT SPEED ERROR
AIRCRAFT ALTITUDE ACTUAL
AIRCRAFT ALTITUDE ERROR
BALLISTIC DISTANCE ACTUAL
BALLISTIC DISTANCE PREDICTED
BALLISTIC TIME ACTUAL
BALLISTIC TIME PREDICTED
SPLASH POINT RANGE ACTUAL
SPLASH POINT RANGE PREDICTED
SPLASH POINT ANGLE ON THE BOW ACTUAL
SPLASH POINT LATITUDE ACTUAL
SPLASH POINT LONGITUDE ACTUAL
PRESET SEARCH DEPTH ACTUAL
PRESET MODE ACTUAL

SPLASH POINT RANGE IDEAL
SPLASH POINT ANGLE ON THE BOW IDEAL
SPLASH POINT LEAD ANGLE ACTUAL
SPLASH POINT LEAD ANGLE IDEAL
TORPEDO RUN TIME
MAXIMUM RANGE CONTACT HELD
TAS ERROR ALONG
TAS ERROR ACROSS
BALLISTIC/WEAPON DEVIATION ERROR FROM IDEAL
BALLISTIC/WEAPON DEVIATION ERROR ALONG
BALLISTIC/WEAPON DEVIATION ERROR ACROSS
SHIPBOARD SYSTEMS TOTAL ERROR
SHIPBOARD SYSTEMS ERROR ACROSS
TARGET EVASION/COURSE TO STEER TOTAL ERROR
TARGET EVASION/COURSE TO STEER ERROR ALONG
TARGET EVASION/COURSE TO STEER ERROR ACROSS
SONAR LOCALIZATION (LOC) TOTAL ERROR
LOC ERROR ALONG
LOC ERROR ACROSS
COURSE AND SPEED (CS) DETERMINATION TOTAL ERROR
CS ERROR ALONG
CS ERROR ACROSS
UNDERWATER BATTERY(UB) FCS COMPUTATION ERROR
UBFCS ERROR ALONG
UBFCS ERROR ACROSS
CO ERROR
DHMO ERROR
CT ERROR
DMHT ERROR
TARGET RANGE ERROR
TARGET BEARING ERROR
TORPEDO GYRO ANGLE SETTING ERROR
SD ERROR
RHP ERROR
WEB ERROR
EFFECTIVE RANGE ERROR
AIMING BEARING ERROR
CV ERROR
TIME OF SEPARATION ERROR
TIME OF FLIGHT ERROR
LAUNCHER TRAIN ORDER ERROR
LAUNCHER ELEVATION ORDER ERROR
EFFECTIVE RA ERROR
EFFECTIVE BA ERROR
AIMING RA ERROR
AIMING BA ERROR
JCO ERROR
PROBABILITY OF HIT

3. SHAREM Database

TCLAS
TCOMM
TLATE

4. AIREM Database

DET_OPP
RNG_OPP
FRE_OPP
PL_OPP
TOT_SUB
VAL_SUB
NVAL_SUB
TOT_NSUB
VAL_NSUB
NVAL_NSUB
SRCH_HRS
NBR_FC
NBR_RECL
AVGT_RECL
NBR_ATT
AVGT_PROS
NBR_EXP
NBR_FAIL
VAL_FAL
LOCALIZE
ELP_TIME
ELTM_DET
FIX_MIN
FIX_SD
FX_SAMPL
CUS_MN
CUS_SD
SSPD_MN
SSPD_SD
USPD_MN
USPD_SD
RMS
TRK_SMPL
TRK_PERIOD
PCT_HELD
MAX_HOLD
MN_SBERR
SD_SBERR
MN_UBERR
SD_UBERR
RMS_BERR
BRG_SAMPLE
MN_SRERR
MN_URERR
SD_SRERR

SD_URERR
RMS_RERR
MN_RTGT
SD_RTGT
RNG_SAMPL

APPENDIX E

A. INTEGRATED DATA BASE TABLE DESCRIPTION

ADMINISTRATION	Description/Contents
exerid	Dates and area of exercise
event	Types and times of events
abstract	Overview of exercise
objectiv	Intentions for measures of effectiveness/goals
pident	Identification codes for participants
partic	Participants in each exercise
pacer	PACER administrative concerns
SETTINGS AND EQUIPMENT	
particeq	Participant equipment configurations
sonrmode	Sonar operating mode changes
subaugm	Target augmentation frequencies and levels
subspl	Beartrap data on exercise submarines
subexpos	Audible/visible submarine events
aim_ii	Sonar equipment configuration
subspl2	More SPL data on exercise submarines
ENVIRONMENTAL DATA/PREDICTION	
weather	Detailed description recorded by participants
btsvloc	Location of XBT drops
btsvpdat	Temperature vs. depth data
actrng	Active range predictions by participants
passrng	Passive range predictions by participants
ambient	Ambient noise measurements by participants
CONTACT INFORMATION	
tims8	Active sonar contacts
tims24	Passive sonar contacts
tims30	Deployed sonobuoy/helo dip data
tims5&9	Non-acoustic contact data
tracks	Participant movements
intertgt	Ranges and bearings between units
ATTACK INFORMATION	
tims31	Aircraft attack information
tims11	Ship attack information
srfcm	Ship countermeasures employed

subcm	Submarine countermeasures employed
wpncmdet	Weapon countermeasures detected
allatks	Attack information
wpn_fire	Weapon system and weapon information
sup_atk	Additional fire control system information

<u>COMMAND AND CONTROL</u>

iusscue	IUSS cuing evaluations

B. INTEGRATED DATABASE DATA DICTIONARY

Table: EXERID

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
exname	an10	Exercise name
exstart	d8	Start date of exercise
exend	d8	End date of exercise
exmonth	n2	Month of exercise
exyear	n2	Year of exercise (last two digits)
extmzn	an2	Local time zone of exercise
extype	an10	Type of exercise
exloc	an22	Abbreviated ocean area
exlatlong	an22	Exercise lat/long
shallow	a1	Shallow water exercise (y)
interm	a1	Intermediate water depth exercise (y)
deep	a1	Deep water exercise (y)
ose	an40	Officer scheduling exercise
oce	an40	Officer conducting exercise

Table: EVENT

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
evtype	an45	Type of event (work up, firing, detection, etc.)
tz	an2	Time zone used for data entry (must be zulu)
comex	n9	Event start (dddhhmmss)
finex	n9	Event stop (dddhhmmss)

Table: ABSTRACT

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
textseq	n3	Sequential numbers for indexing each line of text
abstract	an99	Brief narrative of exercise/significant results

Table: OBJECTIV

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
textseq	n3	Sequential numbers for indexing each line of text
objective	an99	Text of objectives

Table: PIDENT

ATTRIBUTE	TYPE	DESCRIPTION
pid	an10	Alphanumeric code assigned to each participant
type	an10	Hull type or aircraft type (FF, DD, VP, HS)
num	an10	Hull number or aircraft side number
ptype	a3	Type of participant
squad/gp	an20	Ship/aircraft squadron or group
homeport	an20	Homeport of participant
clid	an8	Class leader of participant (DD963, P3C, etc.)
cntry	a2	Two letter country codes
pname	an25	Name of participant

Table: PARTIC

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
id	an8	Hull, side, register, or flight number
occn	n3	Occurrence number: Denotes repetitive appearance of same pid in an event/exercise
prmas	a1	Prairie/masker status (y/n)
numprop	n1	Number of propellers (non-air only)
numblds	n1	Number of blades per propeller (non-air only)
shftrpm	n3	Turns per knot ratio for 10 knots (non-air only)

Table: PACER

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
coord	an25	PACER coordinator
date	d9	Debrief date
loc	an25	Debrief location
site	an25	PACER site

Table: PARTICEQ

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
pid	an10	Alphanumeric code assigned to each participant
eqtype	a3	Equipment type
eqid	an12	Equipment Mk-mod, A/N designation, or noun name
eqstatus	a4	Equipment status
rmk	an30	Clarify equipment usage if necessary

Table: SONRMODE

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
jtim	n9	Log entry time of change (jjjhhmmss)
sonr	an10	Sonar/buoy type (SQS26C, SQR19, BQQ5, etc.)
status	a4	Sonar status
pbbstat	a4	Passive broadband equipment status
amode	a6	Sonar mode
secntr	n3	Sector center in degrees true (-1 for omni)
secwidth	n3	Sector width in degrees true (-1 for omni)
scale	n6	Range scale/zone width in Kyds (-1 for omni)
zstart	n6	Zone start for sector in Kyds (-1 for omni)
freq	an5	Sonar/buoy frequency setting
atten	n2	Transmit power attenuation (dB)
depress	n2	Sonar depression angle in degrees (0 if unk)
sendpath	n4	Depth of sensor in feet (-1 if unk)
odtpulse	n3	ODT pulse length in msec (-1 if unk, 0 if suppressed)
perform	an10	Sonar performance (good, fair, etc.)
sonmrc	a5	Sonar MRC (sat, unsat)

Table: SUBAUGM

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
jtim	n9	Time (jjjhhmmss)
tgtind	an3	Target index
tgttype	a6	Target type (SSN, SSBN, MMT, SS)

sailnbr	an8	Sail number of mobile target designation
augstat	a1	Augment status
freq1	n10	Frequency number one in hertz
sl1	n4	Source level frequency one
methd1	a1	Method of determining source level
freq2	n10	Frequency number two in hertz
sl12	n4	Source level frequency two
methd2	a1	Method of determining source level
freq3	n10	Frequency number three in hertz
sl13	n4	Source level frequency three
methd3	a1	Method of determining source level
freq4	n10	Frequency number four in hertz
sl14	n4	Source level frequency four
methd4	a1	Method of determining source level
freq5	n10	Frequency number five in hertz
sl5	n4	Source level frequency five
methd5	a1	Method of determining source level
coat	a1	Coated target (y,n)
lfbbl	n3	Low frequency broadband augmentation, low end (hz)
lfbbu	n4	Low frequency broadband augmentation, high end (hz)
lfbbsl	n3	Low frequency broadband source level (dB)
hfbbl	n3	High frequency broadband augmentation, low end (hz)
hfbbu	n4	High frequency broadband augmentation, high end (hz)
hfbbsl	n3	High frequency broadband source level (dB)
tgtstrg	n3	Target strength (dB)
tgtclass	an8	Classification of target by predefined characteristics
rmks	an99	Remarks

Table: SUBSPL

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
jtim	n9	Time (jjjhhmmss)
source	a5	Source of radiated noise (GNATS, NAU, BATTY, DIESL, SELF)
depth	n4	Depth of target in feet
spd	n4	Speed of target in knots
freq	n4	Frequency in hertz
bbul	n4	Broad band upper limit (hz)
rspl	n3	Request spl (GNATS OR NAU)

spl000	n4	Sound pressure level @ 000 degrees relative (dB)
spl010	n4	Sound pressure level @ 010 degrees relative (dB)
spl020	n4	Sound pressure level @ 010 degrees relative (dB)
.	.	.
.	.	.
.	.	.
spl350	n4	Sound pressure level @ 350 degrees relative (dB)

Table: SUBEXPOS

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
jtim	n9	Time (jjjhhmmss)
opmode	n1	Operation mode
exposed	an10	Sub exposed
eqtype	a2	Equipment
eqstat	n1	Equipment status
subrmk	an99	Submarine remarks

Table: AIM_II (ship hull mounted sonars only)

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
jtim	n9	Time (jjjhhmmss)
pid	an10	Unit AIM II data is recorded from
sonr	an6	Sensor data recorded from
secwidth	an25	Sector width/mode/freqs
key_rate	n1	Keying rate: 0 = none 1 = 1x 2 = 2x 3 = 3x
scale	n4	Range scale (Kyds)
fmslope	n1	FM slope: 0 = none 1 = positive 2 = negative
vd_cw_pw	n1	VD/CW pulse width (msec): 0 = none 1 = 10 2 = 30 3 = 100 4 = 300 5 = 500 6 = CP
vd_freq	n1	VD transmission frequency: 0 = none 1 = F1 2 = F2 3 = F3
odt_freq	n1	ODT transmission frequency: 0 = none 1 = F1 2 = F2 3 = F3
atten	n2	Power attenuation (dB)
odt_stat	n1	ODT status: 0 = none 1 = off 2 = on
status	n1	Sonar operating status: 0 = none 1 = act 2 = pass 3 = hand key
sfc_vel	n4	Shallow sound velocity (4600 - 5190 fps)
deep_vel	n4	Deep sound velocity (4600 - 5190 fps)

odtpw	n1	ODT pulse width (msec): 0 = suppressed 1 = 10 2 = 30 3 = 100 4 = 300 5 = 500 6 = CP
amode	n1	Active mode: 0 = none 1 = ODT 2 = BB 3 = CZ 4 = BBTRK 6 = BBTKTF 8 = PDT 9 = N/A
depress	n2	Depression angle (deg)
secctr	n3	Sector center (deg true)
zstart	n3	Zone start (Kyds)

Table: SUBSPL2

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
jtim	n9	Time (jjjhhmmss)
pid	an10	Submarine beartrapped
freq	n4	Frequency recorded (hz)
aspect	n3	Cardinal points measured (deg rel)
depth	n5	Submarine depth at time of beartrap (feet)
speed	n2	Submarine speed at time of beartrap (knots)
latd	n3	Latitude in whole degrees
latm	n4	Latitude minutes
latf	a1	Latitude N/S
lond	n3	Longitude in whole degrees
lonm	n4	Longitude minutes
lonf	a1	Longitude E/W
b_width	n4	Bandwidth used in measurements (hz)
sample_s	n4	Sample size
avgspl	n3	Average spl (dB)
dev	n3	Spl deviation (dB)
remarks	an99	Remarks; denote source of radiated noise

Table: WEATHER

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
jtim	n9	Time (jjjhhmmss)
envind	an3	Environmental index
ceiling	n5	Ceiling height (feet)
visibility	n3	Visibility (nm)
visobs	an50	Weather and obstructions to visibility
airtemp	n5	Air temperature to 1/10 degree (deg f)
precip	a10	Precipitation (LT, MED, HEAVY)
dewpoint	n3	Dewpoint temperature (deg f)
winddir	n3	Wind direction (deg true)
windspd	n3	Wind speed (nm/hr)
skycover	n2	0 for no overcast, 10 for complete overcast

seatemp	n5	Seawater injection temperature to 1/10 degree (deg f)
seastate	n2	Seastate on Beaufort scale
pwave	n2	Wave period (seconds)
hwave	n2	Wave height (feet)
dswell	n3	Swell direction (deg true)
pswell	n2	Swell period (seconds)
hswell	n2	Swell height (feet)
magvar	an5	Magnetic variation to 1/10 degree
magnoise	n1	Magnetic noise on kilo index (1 - 9)
radduct	a1	Radar duct present (y,n)
ductalt	n5	Radar duct altitude (feet)
ducthgt	n5	Radar duct height (feet)
shpdens	a15	Shipping density (HEAVY, MEDIUM, QUIET, REMOTE, VERY REMOTE)
weaxrmk	an99	Weather remarks

Table: BTSVLOC

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
jtim	n9	Time (jjjhhmmss)
latd	n3	Latitude in whole degrees
latm	n4	Latitude minutes
latf	a1	Latitude N/S
lond	n3	Longitude in whole degrees
lonm	n4	Longitude minutes
lonf	a1	Longitude E/W
lat	n9	Latitude (+/-999999.9)s
lon	n9	Longitude (+/-999999.9)s

Table: BTSVPDAT

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
pid	an10	Alphanumeric code assigned to each participant
jtim	n9	Time (jjjhhmmss)
dpth	n4	BT maximum depth (feet)
dtype	a1	Entry key for data type: V:velocity T:temperature
data	n4	Numeric data per dtype: vel(fps) temp(deg F)

Table: ACTRNG

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant

jtim	n9	BT drop time (jjjhhmmss)
appind	an5	Acoustic range prediction index
sonr	an6	Sonar model
sld	n5	Sonic layer depth (feet)
windspd	n3	Wind speed (knots)
botdpth	n5	Bottom depth (feet)
mgs	n2	Bottom loss province (BLP)
system	an8	Prediction system used
release	an8	Software release
spd	n3	Unit speed (knots)
nl	n3	Noise level (dB)
ts	n3	Target strength (dB)
plclass	a2	Propagation loss classification (direct path/convergence zone; good/poor) (GG GP PG PP)
sendpth	n4	Sensor depth (feet)
sonrm	an10	Sonar mode (PDT, ODT, BBTRK, etc.)
pdr	n4	Periscope depth range (Kyds)
bdr	n4	Best depth range (Kyds)
cz1start	n4	First CZ start (Kyds)
cz1stop	n4	First CZ stop (Kyds)
pdbbstart	n4	Periscope depth bottom bounce start (Kyds)
pdbbstop	n4	Periscope depth bottom bounce stop (Kyds)
bdbbstart	n4	Best depth bottom bounce start (Kyds)
bdbbstop	n4	Best depth bottom bounce stop (Kyds)
rmks	an99	Remarks

Table: PASSRNG

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
jtim	n9	BT drop time (jjjhhmmss)
appind	an5	Acoustic range prediction index
sonr	an6	Sonar model
eval	a1	Prediction evaluation: V = initial inputs valid P = parametric input error M = math error O = other error C = SHAREM correction
sld	n5	Sonic layer depth (feet)
windspd	n3	Wind speed (knots)
botdpth	n5	Bottom depth (feet)
mgs	n2	Bottom loss province (BLP)
system	an8	Prediction system used
release	an8	Software release
spd	n3	Unit speed (knots)
freq	n4	Frequency used in calculation (hz)
sl	n3	Source level (dB)

le	n3	Noise level (dB)
rd	n3	Recognition differential (dB)
fom	n3	Figure of merit (dB): From eq. fom=sl-le-rd
sendpth	n4	Sensor depth (feet)
tgtdpth	n4	Target depth (feet)
dpr	n5	Direct path range (Kyds)
cz	n2	Detection to the nTH CZ (n=0,1,2,3,...)
cz1start	n4	First CZ start (Kyds)
cz1stop	n4	First CZ stop (Kyds)

Table: AMBIENT

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
jtim	n9	Time (jjjhhmmss)
anind	an5	Ambient noise measurement index
freq	n4	Frequency measured (hz)
dpth	n5	Depth of measurement (feet)
andb	n3	Measured ambient noise (dB)

Table: TIMS8

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
jtim	n9	Time (jjjhhmmss)
contnum	an4	Contact number for active sonar contacts
brg	n3	True bearing to contact (deg)
rng	n4	Range to contact (nm)
sensor	an6	Sensor holding contact
s	n1	Status: 1=gain 2=update 3=classify 4=lost contact
cty	n2	Classification type
sm	a1	Event type: S=structured F=freeplay
ls	an4	Contact validity: pid=valid I=invalid ??=uneval

Table: TIMS24

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
jtim	n9	Time (jjjhhmmss)
contnum	an4	Contact number for passive sonar contacts

brg	n3	True bearing to contact (deg)
sensor	an6	Sensor holding contact
s	n1	Status: 1=gain 2=update 3=classify 4=lost contact
depth	n4	Sensor depth (feet)
ac	n1	Ambiguity code: 1=port 2=starboard 3=unresolved
freq_a	n4	Frequency A: -99 for broadband; -1 for no data
freq_b	n4	Frequency B: -99 for broadband; -1 for no data
freq_c	n4	Frequency C: -99 for broadband; -1 for no data
cty	n2	Classification type
sm	a1	Event type: S=structured F=freeplay
t_cse	n3	Ambiguous bearing (deg true)
t_br	n3	Target signal to noise ratio (dB)
ls	an4	Contact validity: pid=valid I=invalid ??=uneval

Table: TIMS30

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
sortie	an6	Sortie number
jtim	n9	Time (jjjhhmmss)
contnum	an4	Contact number for passive sonar contacts
s	n1	Status: 1=gain 2=update 3=classify 4=lost contact
buoyid	an20	Buoy type/channel/dip number
lat	an15	Latitude
long	an15	Longitude
depth	n4	Sensor depth (feet)
freq_a	n4	Frequency A: -99 for broadband; -1 for no data
freq_b	n4	Frequency B: -99 for broadband; -1 for no data
freq_c	n4	Frequency C: -99 for broadband; -1 for no data
brg	n3	True bearing to contact (deg)
rng	n5	Range to contact (nm)
cty	n2	Classification type
life	n5	Sonobuoy life (hrs)/dip duration (min)
stores	an6	Aircraft two letter code who deployed buoy or marked dip
bb	a1	Bad buoy flag: blank=good X=bad
su	a1	Event type: S=structured F=freeplay

ls	an4	Contact validity: pid=valid I=invalid ??=uneval

Table: TIMS5&9

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
contnum	an4	Contact number
jtim	n9	Time (jjjhhmmss)
brg	n3	True bearing to contact (deg)
rng	n5	Range to contact (nm)
sensor	an6	Non-acoustic sensor
st	n1	Status: 1=gain 2=update 3=classify 4 = lost contact
cl	n2	Classification type
sm	a1	Event type: S=structured F=freeplay
ls	an4	Contact validity: pid=valid I=invalid ??=uneval

Table: TRACKS

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
jtim	n9	Time (jjjhhmmss)
occn	n4	Occurrence number
latd	n3	Latitude in whole degrees
latm	n4	Latitude minutes
latf	a1	Latitude N/S
lond	n3	Longitude in whole degrees
lonm	n4	Longitude minutes
lonf	a1	Longitude E/W
lat	n9	Latitude (+/-999999.9)s
lon	n9	Longitude (+/-999999.9)s
crs	n3	Course (deg true)
spd	n3	Speed (knots)
dpth	n5	Depth (feet)
head	n3	Heading (deg true)

Table: INTERTGT

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
jtim	n9	Time (jjjhhmmss)
etim	n9	Event time in seconds from start of year

tpid	an3	ID code of target
rng	n6	Range to target
tbrg	n3	Bearing to target (deg true)
brg	n3	Bearing to target (deg rel)
asp	n3	Aspect angle (deg)
code	an10	Codes for key track events

Table: TIMS31

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
sortie	an6	Sortie number
jtim	n9	Time (jjjhhmmss)
buoyid	an20	Buoy type/channel/dip number/air atk no./air non-acoustic contacts
lat	an15	Latitude
long	an15	Longitude
brg	n3	True bearing to contact (deg)
rng	n5	Range to contact (nm)
son_ty	a2	Aircraft two letter code and side number
target	an4	Contact validity: pid=valid I=invalid ??=uneval
eval	n1	Attack eval: 1=valid crit 2=invalid crit 3=excess weapons 4=unevaluated
contnum	an4	Contact number for sonobuoys/attack criteria code
freq	n4	Sonobuoy contact frequency
dopchg	n1	Attacking vehicle and type of attack: First character = attack vehicle: 1=SH2 3=SH3 4=SH60B 5=S3 6=P3 8=OTHER Second character = type of attack/weapon: 1=unknown 5=urgent sim 6=delib. sim 9=actual
band	a1	Attack evaluation: H = hit M = miss S = simulated
cty	n2	Classification type
su	a1	Event type: S=structured F=freeplay
rbrg	n3	Bearing from parent ship to aircraft (deg)
rrng	n5	Range from parent ship to aircraft (nm)

Table: TIMS11

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant

contnum	an4	Contact number
jtim	n9	Time (jjjhhmmss)
brg	n3	True bearing to contact (deg)
rng	n5	Range to contact (nm)
fcsnum	an15	Fire control system number
sm	a1	Event type: S=structured F=freeplay
hm	a1	Hit/miss code: H = hit M = miss S = SIMATK
rm	an4	Contact validity: pid=valid I=invalid ??=uneval
at	n2	Attack criteria
ta	n2	Type of attack code

Table: SRFCM

<u>ATTRIBUTE</u>	<u>TYPE</u>	<u>DESCRIPTION</u>
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
jtim	n9	Time (jjjhhmmss)
cmdact	n9	cm deactivate time (jjjhhmmss)
cmtyp	a3	Type: NIX = nixie RCT = react KNU = knuckles FAN = fanfare
cmopmd	a1	Operation mode: N = noise P = pulsed X = N/A S = swept A = alternate C = combination/see rmks
cycle	a1	Cycle timer (y,n)
tmoff	n2	Cycle timer off (sec)
tmon	n2	Cycle timer on (sec)
filter	n3	Filter: col 1 = 1, filter 1 on col 2 = 2, filter 2 on col 3 = 3, filter 3 on
towscop	n3	Tow scope (feet)
cmrmk	an99	Remarks

Table: SUBCM

<u>ATTRIBUTE</u>	<u>TYPE</u>	<u>DESCRIPTION</u>
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
jtim	n9	Time (jjjhhmmss)
cmtyp	a3	Type
cmopmd	a1	Operation mode: N = noise P = pulsed X = N/A S = swept A = alternate C = combination/see rmks
hdth	a2	Hover depth (UP,DN,'blank')
dlay	n3	Delay time (min)
tube	n1	Tube number cm launched from
own	n3	Own ship course (deg true)

dettm	n9	Detection time (jjjhhmmss)
cmrmk	an99	Remarks: reason employed

Table: WPNCMDET

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
pid	an10	Alphanumeric code assigned to each participant
jtim	n9	Time (jjjhhmmss)
cntnum	an4	Contact number: P-passive, A-active, M-mad, etc., plus three digit contact number
clas	a1	Classification: U = unk T = torpedo C = cm S = sus charge
dbrg	n3	Detection bearing (deg true)
drng	n6	Detection range
clastm	n9	Classification time (jjjhhmmss)
mthd	an4	Classification method
cmtype	an3	CM type
wcmrmk	an99	Remarks

Table: ALLATKS

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
jtim	n9	Time (jjjhhmmss)
sortie	an6	Sortie number
atknum	an6	Attack number (ATK01, ATK02, ...) reattacks (ATK01A)
apid	an10	Unit conducting attack
vpid	an10	Vectoring unit pid
rpid	an10	Reference unit pid
ipid	an10	Intended target pid
tpid	an10	Target pid
wpid	an10	Weapon pid
atkbrg	n3	Attack bearing (deg true)
atkrng	n6	Attack range (yards)
atklat	an15	Attack latitude
atklong	an15	Attack longitude
validity	a1	Attack validity: U = not evaluated V = valid contact attacked I = invalid contact attacked
tacdoc	a1	Tactical doctrine followed (y,n)
atkcrit	n2	Attack criteria
lmode	n2	Launch mode
evttype	n1	Type of event
rmks	an99	Remarks

Table: WPN_FIRE

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
jtim	n9	Time (jjjhhmmss)
sortie	an6	Sortie number
atknum	an6	Attack number (ATK01, ATK02, ...) reattacks (ATK01A)
apid	an10	Unit conducting attack
regnr	n10	Torpedo register number
config	an20	Torpedo configuration
mod	an10	Torpedo mod
mk	n2	Torpedo Mk
lchrtyp	an20	launcher type (tube no., ASROC, acft station no.)
gyro	n3	Gyro angle for snake search and HATS (deg)
tangle	n3	SVTT tube train angle (deg rel)
isd	n4	Initial search depth (feet)
horrng	n5	horizontal range (ASROC) (yards)
entbrg	n3	Water entry bearing (ASROC) (deg true)
effrng	n5	Effective range (yards)
covel	n4	Cutoff velocity (ASROC) (fps)
tosep	n5	Time of separation (ASROC) (sec)
toflt	n5	Time of flight (sec)
lchrtrord	n7	Launcher train order (ASROC) (dddmmss)
lchrelord	n7	Launcher elevation order (ASROC) (dddmmss)
J(co)	n3	Course to steer (SVTT) (deg true)
splbrg	n3	Splash point bearing from aircraft (deg true)
splrng	n6	Splash point range from aircraft (yards)
evade	a1	Did target attempt to evade (y,n)
cm	a1	Countermeasures employed (y,n)
webrg	n3	Bearing from target to torpedo water entry point (wep) (deg rel)
werng	n6	Range from target to wep (yards)
placed	n1	Weapon placement: 1 = good 2 = poor 3 = unknown
hit	n1	Acquisition & home to hit: 1 = yes 2 = no, did not acquire 3 = no, acquired-lost
acqrng	n5	Initial acquisition range (yards)
acqtim	n6	Initial acquisition time from TOF (sec)
eor	n6	Total torpedo run time (sec)
run	n2	Run evaluation
phit	n4	Calculated probability of hit

Table: SUP_ATK

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
jtim	n9	Time (jjjhhmmss)
sortie	an6	Sortie number
atknum	an6	Attack number (ATK01, ATK02, ...) reattacks (ATK01A)
regnr	n10	Torpedo register number
fccrse	n3	FC solution for target course (deg true)
fcspd	n3	FC solution for target speed (knots)
fcdpth	n5	FC solution for target depth (feet)
lpcrse	n3	Launch platform course (deg true)
lpspd	n3	Launch platform speed (knots)
lpalt	n5	Launch platform altitude (feet)
rmks	an99	Remarks

Table: IUSSCUE

ATTRIBUTE	TYPE	DESCRIPTION
exid	n3	Exercise number
event	n4	Event number (0 = all events)
msgdtg	n9	DTG of SOSUS RED/RED AMP or voice report (jjjhhmmss)
commpath	n1	Coded entry: 1 = VOX 2 = hard copy 3 = JOTS 4 = other 5 = not received
desig	an4	COSP/COSL designator from message
msgqual	a3	Message qualifier: INT = initial report AMP = amplifying report CAN = cancellation UNK = unknown
qualnr	n3	Serial number of qualifier
pid	an10	ID code of unit receiving IUSS cuing
msgtor	n9	Time of receipt of message or VOX (jjjhhmmss)
type	a1	SPA type: E = ellipse C = circular B = bearing box W = bearing wedge
latd	n3	Latitude in whole degrees
latm	n4	Latitude minutes
latf	a1	Latitude N/S
lond	n3	Longitude in whole degrees
lonm	n4	Longitude minutes
lonf	a1	Longitude E/W
brg	n3	Bearing of wedge or box, or inclination of ellipse semi-major axis
length	n6	Radius of circular SPA, length of semi-major axis of ellipse, range from bearing line for box or wedge (nm)
width	n6	Length of semi-minor axis for ellipse, or half-width for bearing box or bearing wedge (nm)
sqnm	n6	Size of SPA. Blank for wedge. (nm)

tevnt	n9	Event time from message (jjjhhmmss)
evnt	an10	Event from message
sensor	an6	Sensor/source from message
sensorpid	an10	Pid of SURTASS ship/SOSUS/FDS
tpid	an10	Target pid
inspa	a1	Containment in SPA at tevnt: Y = yes N = no U = unknown I = invalid
tclas	n4	Derived time btwn tevnt and msgdtg (min)
tcomm	n4	Derived time btwn msgdtg and msgtor (min)
tlate	n4	derived time late of hard cuing info equal to sum of tclas and tcomm

Table: EXTYPE

DATA	AN10	DESCRIPTION
artic	Ice/marginal ice zone	
attack	extorp firing	
bgarem	Battle group SHAREM	
detect	detection	
pentak	Penetrate/attack	
penex	Penetration exercise	
opeval	Operational test	
techeval	Technical test	
lfa	Low frequency active	
c3i	Command, control, communication, and intelligence	

Table: PTYPE

DATA	A3	DESCRIPTION
air	Airborne craft	
sur	Surface ships	
cdr	Commander	
sby	Sonobuoys	
wpn	Weapons	
dec	Decoy	
sub	Submarines	
smk	Smoke markers	
cue	Tipper	

Table: EQTYPE

DATA	A3	DESCRIPTION
son	Sonar	
nav	Navigation	
air	Aircraft	
rad	Radar	
rdt	New items	
nua	Augmentation unit	
dec	OPEC method	
env	Environmental	
cmd	Countermeasure device	
esm	Surveillance measures	

com	Communications
wpn	Weapon systems
fcs	Fire control
ecm	Countermeasures
c3i	Command, control, communications, and intelligence
mad	Magnetic anomaly detection
ird	Infra-red detection

Table: EQSTAT

DATA	A4 DESCRIPTION
up	Equipment operational
inop	Equipment inoperational
degr	Equipment operational but degraded
unk	Equipment status unknown

Table: OPMODE

DATA	N1 DESCRIPTION
1	Quiet
2	Battle quiet
3	Patrol quiet
4	Snorkeling
5	Light cavitation
6	Heavy cavitation
7	Broached
8	Surfaced
9	Unknown

Table: EXPOSED

DATA	N1 DESCRIPTION
b	Brief (<1min)
e	Exposed
t	Transmitting
i	Inoperative
n	No exposure

Table: EQUIP

DATA	A2 DESCRIPTION
ac	A/C plant
bl	Blowers
bs	Blew sanitaries
cp	Coolant pumps
cs	Scrubber
di	Diesels
ep	Shift to epm
ff	Flare fired
fp	Feed pumps
gd	Garbage
hi	Hpac
lp	Lube oil pumps
ma	Masker
mp	Main propulsion

ms	MG/SSTG
mv	Main vent
pr	Prairie
ps	Pump sanitaries
re	Reactors
sp	Seawater pump
st	Stills
tg	Turbo generator
ws	Water slug
na	Not applicable
xx	Other (see remarks)

Table: STAT

DATA	N1 DESCRIPTION
1	On (1-25%)
2	Slow (26-50%)
3	Medium (51-75%)
4	Fast (75%-full)
5	Intermittent
6	Off (but operative)
7	Inoperative
8	Repaired, ready

Table: CLASS

DATA	N1 DESCRIPTION
1	POSSUB 1
2	POSSUB 2
3	PROBSUB 1
4	PROBSUB 2
5	CERTSUB
6	NONSUB
7	Not initially classified POSSUB, but reconstructed to be valid submarine contact

Table: BUOYID

DATA	A2 DESCRIPTION
ac	SSQ47
at	SSQ71
bt	SSQ36/536/937
ca	SSQ523/963
cb	SSQ57
cbb	SPL
cbl	LOFAR
dc	DICASS
df	DIFAR
lo	SSQ41
sa	SSQ83
vl	SSQ77X
dp	Helo dip

Table: CONTNUM

DATA	N2	DESCRIPTION
1	MAD	
2	Active buoy	
3	Dip	
4	Active HMS	
5	Active VDS	
6	Passive buoy	
7	Flare	
8	Radar sinker	
9	Visual scope	
10	Acoustic intercept	
11	Towed array	
12	Passive sonar	
13	HE	
14	EP	
15	Cross-fix	
16	FCS-scope	
17	DR track	
18	IRDS	
19	MAD/active buoy	
20	Visual swirl	
21	Unknown	
22	Range assist	
23	Hydrophone effects	
24	Acoustic tracker	
25	IUSS	
26	Vectored a/c attack	
27	Scope radar track	
28	A/C smoke	

Table: CMTYP

DATA	A3	DESCRIPTION
nix	Nixie	
rct	React	
knu	Knuckles	
fan	Fanfare	
ftc	False target can	
nae	Noise augmentation emit	
ad2		ADC 2.0 anti-torpedo cm
ad1	ADC 1.0 anti-torpedo cm	
mos	Mobile op sub simulator	
mbt	Main ballast tank blow	
oth	Other/see remarks	
tor	Torpedo decoy	

Table: ATCODE1

DATA	N1	DESCRIPTION
First character		
1	Assist ship	
2	SH2	

3	SH3
4	SH60
5	S3
6	P3
7	Own ship
8	Other
9	Own ship based on assist unit contact

Second character

1	Urgent sim RTT
2	Deliberate sim RTT
3	Urgent sim SVTT
4	Deliberate sim SVTT
5	Urgent sim other
6	Deliberate sim other
7	Actual RTT
8	Actual SVTT
9	Actual Other
0	Unknown

Table: LMODE

DATA	N2 DESCRIPTION
00	Unknown
01	ASROC
02	VLA
03	Snake/directed
05	NRO/non-directed
07	Airdrop
08	HATS
09	Sub
10	Other

Table: EVTTYPE

DATA	N1 DESCRIPTION
0	Freeplay - urgency unknown
1	Freeplay - urgent attack
2	Freeplay - deliberate attack
3	Semi-structured
4	Structured - vectored attack
5	SIMATK

Table: RUN

DATA	N1 DESCRIPTION
2	Torpedo problem
3	No malfunction
4	Decoy by CM
5	Decoy by MI
6	Decoy by CM and MI
7	Acquired surface ship
8	Unknown
9	Decoy by false echos

Table: SECWIDTH

DATA	N1 DESCRIPTION
2	3 x 8.5° BBTKTP
3	3 x 8.5° BBTKTF
4	3 x 45° BB
5	3 x 45° BBTF
6	120° CZ or PDT
7	6 x 40°
8	6 x 40° (three freqs)
9	2 x 120°

Table: SONR

DATA	AN6
SQS26C	
SQS35	
SQR181	
SQS53A	
SQS53B	
SQS56	
505VDS	
505HMS	
BQQ5	
AQR13	
SQS23	
SQS23P	
SQR19	
BQR20	
DIMUS	
TQR16	

Table: SYSTEM

DATA	AN8
GFMPL	
SIMASUP	
AIM II	
TOPPS	
NTD-6869	

Table: PLCLASS

DATA	A2 DESCRIPTION
GG	Direct path/convergence zone good/good
GP	Direct path/convergence zone good/poor
PG	Direct path/convergence zone poor/good
PP	Direct path/convergence zone poor/poor

Table: SONRM

DATA	AN10
PDT	
ODT	
BB	
BBTRK	

BBTRKTP
BBTRKTF
CZODT
HANDKEY

Table: EVAL

DATA	A1	DESCRIPTION
V	Initial input valid	
P	Parametric input error	
M	Math error	
O	Other error	
C	SHAREM correction	

Table: S

DATA	N1	DESCRIPTION
1	Gain	
2	Update	
3	Classify	
4	Lost contact	

Table: AC

DATA	N1	DESCRIPTION
1	Port	
2	Starboard	
3	Unresolved	

Table: SON_TY

DATA	A2	DESCRIPTION
SR	HS1	
HH	HS2	
TS	HS3	
BK	HS4	
KS	HS5	
ID	HS6	
DD	HS7	
LF	HS8	
JA	HS9	
CA	HS10	
SL	HS11	
SG	HS12	
CH	HS14	
RN	HS15	
BW	HSL30	
CR	hS131	
IN	HSL32	
SS	HSL33	
GC	HSL34	
MS	HSL35	
LL	HSL36	
ER	HSL37	
AW	HSL40	

IR	HSL41
PW	HSL42
OL	HSL43
MN	HSL44
LW	HSL45
CU	HSL46
SH	HSL47
SE	VP1
SD	VP4
MF	VP5
BR	VP6
TG	VP8
GE	VP9
RL	VP10
FP	VP11
WE	VP16
WL	VP17
BG	VP22
BM	VP24
TR	VP26
PN	BLVP31
FM	VP40
PL	VP45
GK	VP46
GS	VP47
WP	VP49
BD	VP50
CB	VP60
BA	VP62
CO	VP64
TD	VP65
LB	VP66
GH	VP67
BH	VP68
TM	VP69
LI	VP90
BC	VP91
MM	VP92
EX	VP93
CF	VP94
OB	VPU1
WZ	VPU2
BS	VS21
VI	VS22
SC	VS24
WO	VS27
GA	VS28
DF	VS29
DY	VS30
LH	VS31
MA	VS32

SA	VS33
SB	VS37
RG	VS38
IM	VS41

Table: ATKEVL

DATA	N1	DESCRIPTION
1	Valid Criteria	
2	Invalid criteria	
3	Excess weapons	
4	Unevaluated	

Table: DOPCHG

DATA	N1	DESCRIPTION
First character = attacking vehicle		
1	SH2	
3	SH3	
4	SH60B	
5	S3	
6	P3	
8	Other	
Second character = type of attack/weapon		
1	Unknown	
5	Urgent sim	
6	Deliberate sim	
9	Actual	

Table: CMOPMD

DATA	A1	DESCRIPTION
N	Noise	
P	Pulsed	
X	N/A	
S	Swept	
A	Alternate	
C	Combination/see remarks	

Table: CLAS

DATA	A1	DESCRIPTION
U	Unknown	
T	Torpedo	
C	Countermeasure	
S	SUS charge	

Table: MTHD

DATA	AN4	DESCRIPTION
PPI	Planned position indicator	
DIM	DIMUS	
ARR	Array	
AIR	Acoustic intercept receiver	
WQC	U/W phone	

S54	SQS 54
S17	SQR 17

Table: COMMPATH

DATA	N1	DESCRIPTION
1	VOX	
2	Hard copy	
3	JOTS	
4	Other	
5	Not received	

Table: TYPE

DATA	A1	DESCRIPTION
E	Ellipse	
C	Circular	
B	Bearing box	
W	Bearing wedge	

Table: VALIDITY

DATA	A1	DESCRIPTION
U	Not evaluated	
V	Valid contact attacked	
I	Invalid contact attacked	

Table: PLACED

DATA	N1	DESCRIPTION
1	Good	
2	Poor	
3	Unknown	

Table: HIT

DATA	N1	DESCRIPTION
1	Yes	
2	No, did not acquire	
3	No, acquired - lost contact	

Table: FMSLOPE

DATA	N1	DESCRIPTION
0	None	
1	Positive	
2	Negative	

Table: PULSE

DATA	N1	DESCRIPTION
0	None	
1	10 msec	
2	30 msec	
3	100 msec	
4	300 msec	
5	500 msec	
6	Continuous pulse	

Table: RATE

DATA	N1	DESCRIPTION
1	1 times	
2	2 times	
3	3 times	

Table: FREQ

DATA	N1	DESCRIPTION
0	None	
1	F1	
2	F2	
3	F3	

Table: ODTSTAT

DATA	N1	DESCRIPTION
0	None	
1	Off	
2	On	

Table: STATUS

DATA	N1	DESCRIPTION
0	None	
1	Active	
2	Passive	
3	Handkey	

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